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Cross-sections of large-angle hadron production in proton– and pion–nucleus interactions II: beryllium nuclei and beam momenta from ±3 GeV/c to ±15 GeV/c

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Abstract We report on double-differential inclusive cross-sections of the production of secondary protons and charged pions, in the interactions with a 5% λ_{abs} thick stationary beryllium target, of proton and pion beams with momentum from ±3 GeV/c to ±15 GeV/c. Results are given for secondary particles with production angles $20° < \theta < 125°$.

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1 Introduction

The HARP experiment arose from the realization that the inclusive differential cross-sections of hadron production in the interactions of few GeV/c protons with nuclei were known only within a factor of two to three, while more precise cross-sections are in demand for several reasons. Consequently, the HARP detector was designed to carry out a programme of systematic and precise measurements of hadron production by protons and pions with momenta from 1.5 to 15 GeV/c.

The detector combined a forward spectrometer with a large-angle spectrometer. The latter comprised a cylindrical Time Projection Chamber (TPC) around the target and an array of Resistive Plate Chambers (RPCs) that surrounded the TPC. The purpose of the TPC was track reconstruction and particle identification by $\mathrm{d}E/\mathrm{d}x$. The purpose of the RPCs was to complement the particle identification by time of flight.

The HARP experiment was performed at the CERN Proton Synchrotron in 2001 and 2002 with a set of stationary targets ranging from hydrogen to lead, including beryllium.

Here, we report on the large-angle production (polar angle θ in the range $20° < \theta < 125°$) of secondary protons and charged pions in the interactions with a 5% λ_{abs} Be target of protons and pions with beam momenta of ±3.0, ±5.0, ±12.0, and ±15.0 GeV/c. We have reported earlier [1] on results from beam momenta of +8.9 and −8.0 GeV/c.

Our work involves only the HARP large-angle spectrometer. The detector characteristics and our analysis algorithms have been described in Ref. [1].

The data analysis presented in this paper rests exclusively on the calibrations of the TPC and the RPCs that we, the HARP–CDP group, published in Refs. [2] and [3]. As discussed in Refs. [4] and [5], and summarized succinctly in the appendix of Ref. [1], our calibrations disagree with those published by the 'HARP Collaboration' [6–9]. Conclusions of independent review bodies on the discrepancies between our results and those from the HARP Collaboration can be found in Refs. [10, 11].

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2 The T9 proton and pion beams, and the target

The protons and pions were delivered by the T9 beam line in the East Hall of CERN's Proton Synchrotron. This beam line supports beam momenta between 1.5 GeV/c and 15 GeV/c, with a momentum bite $\Delta p/p \sim 1\%$.

Beam particle identification was provided for by two threshold Cherenkov counters, BCA and BCB, filled with nitrogen, and by time of flight over a flight path of 24.3 m. Table 1 lists the beam instrumentation that was used at different beam momenta for p/π^+ and for π/e separation.

The pion beam had a contamination by muons from pion decays. It also had a contamination by electrons from converted photons from π^0 decays. Only for the beam momenta of 3 and 5 GeV/c were electrons identified by a beam Cherenkov counter and rejected.

The fractions of muon and electron contaminations of the pion beam were experimentally determined [12, 13] and are listed in Table 2 for all beam momenta.[1] For the determination of interaction cross-sections of pions, the muon and electron contaminations must be subtracted from the incoming flux of pion-like particles (except electrons at the beam momenta of 3 and 5 GeV/c).

The kaon contamination in the proton and pion beams is at the per-cent level. Beam kaons are rejected either by TOF or suppressed by the beam Cherenkov response; only at 5 GeV/c kaons are indistinguishable from pions. Because the kaon interaction cross-sections are close to the proton and pion interaction cross-sections, this contamination is ignored.

Table 1 Beam instrumentation for p/π^+ and π/e separation

Beam momentum [GeV/c]	p/π^+ separation	π/e separation
±3.0	TOF	BCB (1.05 bar)
±5.0	TOF	BCA (0.60 bar)
	BCB (2.50 bar)	
−8.0 and +8.9	BCA (1.25 bar)	
	BCB (1.50 bar)	
±12.0 and ±15.0	BCA (3.50 bar)	
	BCB (3.50 bar)	

Table 2 Contaminations of the pion beams by muons and electrons

Beam momentum [GeV/c]	Muon fraction [%]	Electron fraction [%]
±3.0	4.1 ± 0.4	rejected
±5.0	5.1 ± 0.4	rejected
−8.0	1.9 ± 0.5	1.2 ± 0.5
+8.9	1.7 ± 0.5	1.2 ± 0.5
±12	0.6 ± 0.6	0.5 ± 0.5
±15	0.0 ± 0.5	0.0 ± 0.5

[1]For the −8.0 GeV/c beam, the same electron contamination was taken as in the +8.9 GeV/c beam.

The beam trajectory was determined by a set of three multiwire proportional chambers (MWPCs), located upstream of the target, several meters apart. The transverse error of the impact point on the target was 0.5 mm from the resolution of the MWPCs, plus a contribution from multiple scattering of the beam particles in various materials in the beam line. Excluding the target itself, the latter contribution is 0.2 mm for a 8.9 GeV/c beam particle.

We select 'good' beam particles by requiring the unambiguous reconstruction of the particle trajectory with good χ^2. In addition we require that the particle type is unambiguously identified. We select 'good' accelerator spills by requiring a minimal intensity and a 'smooth' variation of beam intensity across the 400 ms long spill.[2]

The target was a cylinder made of high-purity (99.95%) beryllium, with a density of 1.85 g/cm^3, a radius of 15 mm, and a thickness of 20.5 ± 0.1 mm (5% λ_{abs}).

The finite thickness of the target leads to a small attenuation of the number of incident beam particles. The attenuation factor is $f_{\text{att}} = 0.975$.

The size of the beam spot at the position of the target was several millimeters in diameter, determined by the setting of the beam optics and by multiple scattering. The nominal beam position[3] was at $x_{\text{beam}} = y_{\text{beam}} = 0$, however, excursions by several millimeters could occur.[4] A loose fiducial cut $\sqrt{x^2_{\text{beam}} + y^2_{\text{beam}}} < 12$ mm ensured full beam acceptance. The muon and electron contaminations of the pion beam, stated above, refer to this acceptance cut.

3 The HARP large-angle detectors

Our calibration work on the HARP TPC and RPCs is described in detail in Refs. [2] and [3], and in references cited therein. In particular, we recall that static and dynamic TPC track distortions up to 10 mm have been corrected to better than 300 μm. Therefore, TPC track distortions do not affect the precision of our cross-section measurements.

[2]A smooth variation of beam intensity eases corrections for dynamic TPC track distortions.

[3]A right-handed Cartesian and/or spherical polar coordinate system is employed; the z axis coincides with the beam line, with $+z$ pointing downstream; the coordinate origin is at the center of the beryllium target, 500 mm downstream of the TPC's pad plane; looking downstream, the $+x$ coordinate points to the left and the $+y$ coordinate points up; the polar angle θ is the angle with respect to the $+z$ axis.

[4]The only relevant issue is that the trajectory of each individual beam particle is known, whether shifted or not, and therefore the amount of matter to be traversed by the secondary hadrons.

The resolution $\sigma(1/p_T)$ is typically 0.2 $(\mathrm{GeV}/c)^{-1}$ and worsens towards small relative particle velocity β and small polar angle θ.

The absolute momentum scale is determined to be correct to better than 2%, both for positively and negatively charged particles.

The polar angle θ is measured in the TPC with a resolution of ∼9 mrad, for a representative angle of $\theta = 60°$. To this a multiple scattering error has to be added which is ∼7 mrad for a proton with $p_T = 500$ MeV/c and $\theta = 60°$, and ∼4 mrad for a pion with the same characteristics. The polar-angle scale is correct to better than 2 mrad.

The TPC measures $\mathrm{d}E/\mathrm{d}x$ with a resolution of 16% for a track length of 300 mm.

The intrinsic efficiency of the RPCs that surround the TPC is better than 98%.

The intrinsic time resolution of the RPCs is 127 ps and the system time-of-flight resolution (that includes the jitter of the arrival time of the beam particle at the target) is 175 ps.

To separate measured particles into species, we assign on the basis of $\mathrm{d}E/\mathrm{d}x$ and β to each particle a probability of being a proton, a pion (muon), or an electron, respectively. The probabilities add up to unity, so that the number of particles is conserved. These probabilities are used for weighting when entering tracks into plots or tables.

4 Monte Carlo simulation

We used the Geant4 tool kit [14, 15] for the simulation of the HARP large-angle spectrometer.

We had expected that Geant4 would provide us with reasonably realistic spectra of secondary hadrons. We found this expectation met by Geant4's so-called QGSP_BIC physics list, but only for the secondaries from incoming beam protons with momentum less than 12 GeV/c. For the secondaries from beam protons at 12 and 15 GeV/c momentum, and from beam pions at all momenta, we found the standard physics lists of Geant4 unsuitable [16].

To overcome this problem, we built our own physics list (HARP_CDP) for the production of secondaries from incoming beam pions. It starts from Geant4's standard QBBC physics list, but the Quark–Gluon String Model is replaced by the FRITIOF string fragmentation model for kinetic energy $E > 6$ GeV; for $E < 6$ GeV, the Bertini Cascade is used for pions, and the Binary Cascade for protons; elastic and quasi-elastic scattering is disabled. Examples of the good performance of the HARP_ CDP physics list are given in Ref. [16].

5 Systematic errors

The systematic precision of our inclusive cross-sections is at the few-per-cent level, from errors in the normalization, in the momentum measurement, in particle identification, and in the corrections applied to the data.

The systematic error of the absolute flux normalization is taken as 2%. This error arises from uncertainties in the target thickness, in the contribution of large-angle scattering of beam particles, in the attenuation of beam particles in the target, and in the subtraction of the muon and electron contaminations of the beam. Another contribution comes from the removal of events with an abnormally large number of TPC hits above threshold.[5]

The systematic error of the track finding efficiency is taken as 1% which reflects differences between results from different persons who conducted eyeball scans. We also take the statistical errors of the parameters of a fit to scan results as systematic error into account [1]. The systematic error of the correction for losses from the requirement of at least 10 TPC clusters per track is taken as 20% of the correction which itself is in the range of 5 to 30%. This estimate arose from differences between the four TPC sectors that were used in our analysis, and from the observed variations with time.

The systematic error of the p_T scale is taken as 2% as discussed in Ref. [2].

The systematic errors of the proton, pion, and electron abundances are taken as 10%. We stress that errors on abundances only lead to cross-section errors in case of a strong overlap of the resolution functions of both identification variables, $\mathrm{d}E/\mathrm{d}x$ and β. The systematic error of the correction for migration, absorption of secondary protons and pions in materials, and for pion decay into muons, is taken as 20% of the correction, or 1% of the cross-section, whichever is larger. These estimates reflect our experience with remanent differences between data and Monte Carlo simulations after weighting Monte Carlo events with smooth functions with a view to reproducing the data simultaneously in several variables in the best possible way.

All systematic errors are propagated into the momentum spectra of secondaries and then added in quadrature.

6 Cross-section results

In Tables A.1–A.36, collated in the Appendix, we give the double-differential inclusive cross-sections $\mathrm{d}^2\sigma/\mathrm{d}p\,\mathrm{d}\Omega$ for all 36 combinations of incoming beam particle and secondary particle, including statistical and systematic errors. In each bin, the average momentum at the vertex and the average polar angle are also given.

The data of Tables A.1–A.36 are available in ASCII format in Ref. [17].

[5] Very rarely, because of apparatus malfunction, the number of TPC hits was much larger than possible for a physics event. Such events are considered unphysical and eliminated.

Cross-sections are only given if the total error is not larger than the cross-section itself. Since our track reconstruction algorithm is optimized for tracks with p_T above $\sim$70 MeV/c in the TPC volume, we do not give cross-sections from tracks with p_T below this value. Because of the absorption of slow protons in the material between the vertex and the TPC gas, and with a view to keeping the correction for absorption losses below 30%, cross-sections from protons are limited to $p > 350$ MeV/c at the interaction vertex. Proton cross-sections are also not given if a 10% error on the proton energy loss in materials between the interaction vertex and the TPC volume leads to a momentum change larger than 2%. Pion cross-sections are not given if pions are separated from protons by less than twice the time-of-flight resolution.

The larger than usual error bars for the +15 GeV/c pion beam are caused by scarce statistics because the beam composition was dominated by protons.

We present in Figs. 1 to 7 what we consider salient features of our cross-sections. In these figures, we also show the data from the +8.9 GeV/c and −8.0 GeV/c beams that we published in Ref. [1].

Figure 1 shows the inclusive cross-sections of the production of protons, π^+'s, and π^-'s, from incoming protons between 3 GeV/c and 15 GeV/c momentum, as a function of their charge-signed p_T. The data refer to the polar-angle range $20° < \theta < 30°$. Figures 2 and 3 show the same for incoming π^+'s and π^-'s.

Figure 4 shows the inclusive cross-sections of the production of protons, π^+'s, and π^-'s, from incoming protons between 3 GeV/c and 15 GeV/c momentum, this time as a function of their charge-signed polar angle θ. The data refer to the p_T range $0.24 < p_T < 0.30$ GeV/c. In this p_T range pions populate nearly all polar angles, whereas protons are absorbed at large polar angle and thus escape measurement. Figures 5 and 6 show the same for incoming π^+'s and π^-'s.

These figures highlight the rather strong differences in the production of proton, π^+ and π^- secondaries for different beam particles and beam momenta.

In Fig. 7, we present the inclusive cross-sections of the production of secondary π^+'s and π^-'s, integrated over the momentum range $0.2 < p < 1.0$ GeV/c and the polar-angle range $30° < \theta < 90°$ in the forward hemisphere, as a function of the beam momentum.

7 Comparison of our results with results from other experiments

7.1 Comparison with E802 results

Experiment E802 [18] at Brookhaven National Laboratory measured secondary charged pions in the polar-angle range $5° < \theta < 58°$ from the interactions of +14.6 GeV/c protons with beryllium nuclei.

Figure 8 shows their published Lorentz-invariant cross-section of π^+ and π^- production by +14.6 GeV/c protons, in the rapidity range $1.2 < y < 1.4$, as a function of $m_T - m_\pi$, where m_T denotes the pion transverse mass. Their data are compared with our cross-sections from the interactions of +15.0 GeV/c protons with beryllium nuclei, expressed in the same unit as used by E802. Since E802 quoted only statistical errors, our data in Fig. 8 are also shown with their statistical errors.

The E802 $\pi^\pm$ cross-sections are in good agreement with our cross-sections measured nearly at the same proton beam momentum, taking into account the normalization uncertainty of (10–15)% quoted by E802. We draw attention to the good agreement of the slopes of the cross-sections over two orders of magnitude.

7.2 Comparison with E910 results

Experiment E910 [19] at Brookhaven National Laboratory measured secondary charged pions in the momentum range 0.1–6 GeV/c from the interactions of +12.3 GeV/c protons with beryllium nuclei. This experiment used a TPC for the measurement of secondaries, with a comfortably large track length of $\sim$1.5 m. This feature, together with a magnetic field strength of 0.5 T, is of particular significance, since it permits considerably better charge identification and proton–pion separation by $\mathrm{d}E/\mathrm{d}x$ than is possible in the HARP detector. Figure 9 shows their published cross-section $\mathrm{d}^2\sigma/\mathrm{d}p\,\mathrm{d}\Omega$ of $\pi^\pm$ production by +12.3 GeV/c protons, in the polar-angle range $0.8 < \cos\theta < 0.9$. Since E910 quoted only statistical errors, our data in Fig. 9 from the interactions of +12.0 GeV/c protons are also shown with their statistical errors. The normalization uncertainty quoted by E910 is $\leq$5%.

Also here, the E910 data are shown as published, and our data are expressed in the same unit as used by E910. We draw attention to the good agreement in the π^+/π^- ratio between the cross-sections from E910 and our cross-sections. See also Fig. 10(b) in Sect. 7.3.

7.3 Comparison with results from the HARP Collaboration

Figure 10(a) shows the comparison of our cross-sections of pion production by +12.0 GeV/c protons off beryllium nuclei with the ones published by the HARP Collaboration [20], in the polar-angle range $0.35 < \theta < 0.55$ rad. The latter cross-sections are plotted as published, while we expressed our cross-sections in the unit used by the HARP Collaboration. Figure 10(b) shows our ratio π^+/π^- as a function of the polar angle θ in comparison with the ratios

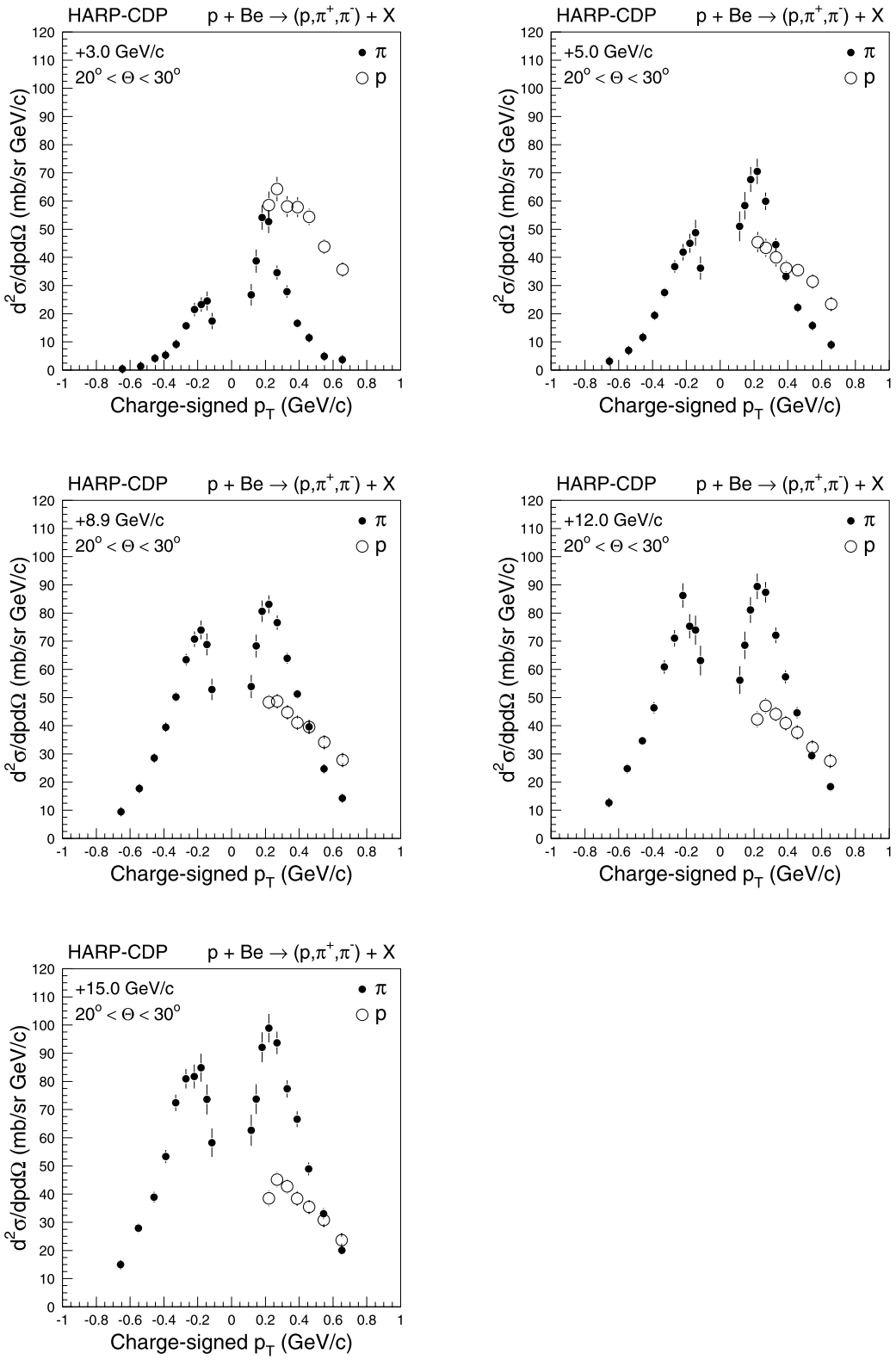

Fig. 1 Inclusive cross-sections of the production of secondary protons, π^+'s, and π^-'s, by protons on beryllium nuclei, in the polar-angle range $20^\circ < \theta < 30^\circ$, for different proton beam momenta, as a function of the charge-signed p_T of the secondaries; the shown errors are total errors

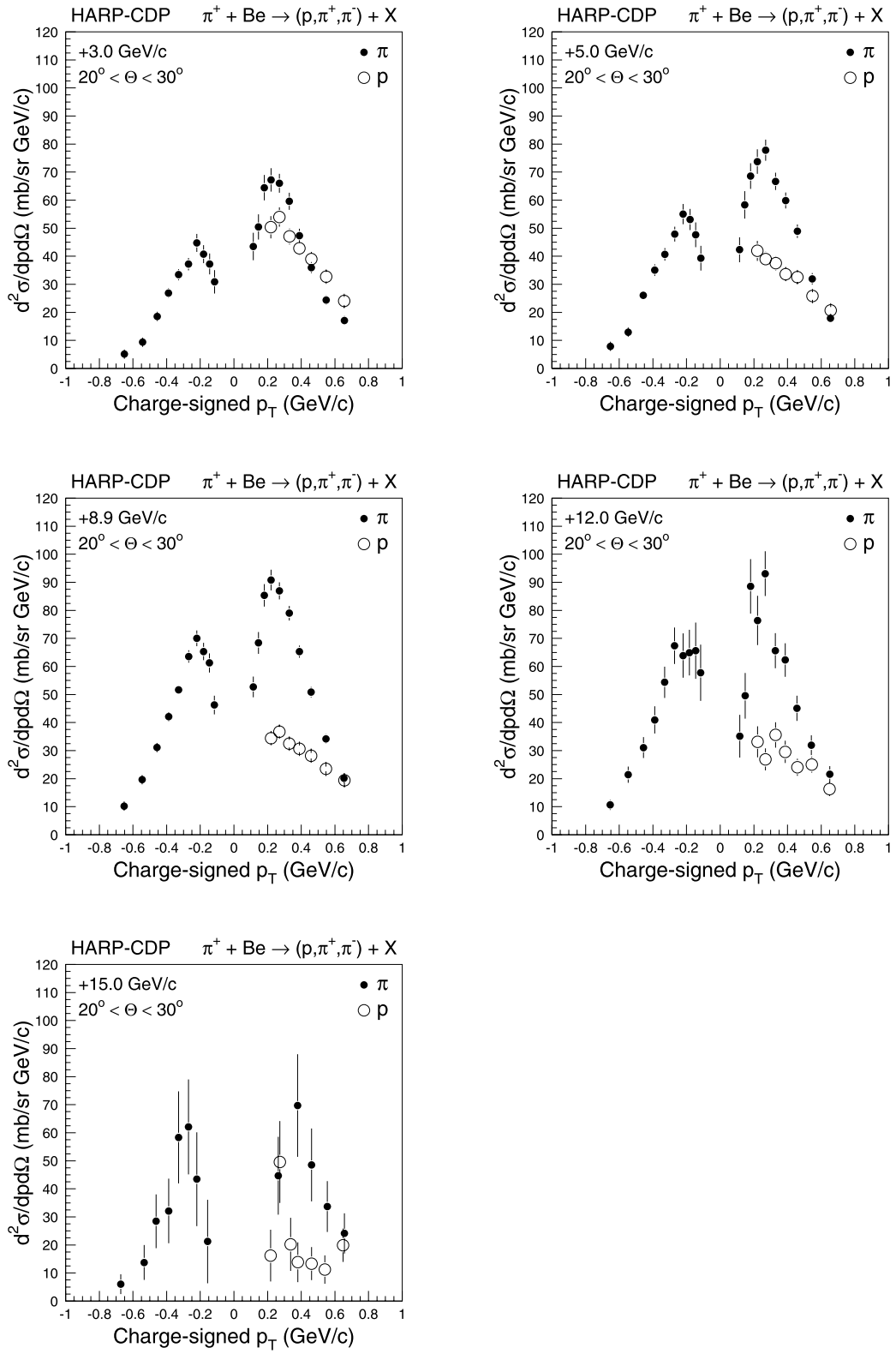

Fig. 2 Inclusive cross-sections of the production of secondary protons, π^+'s, and π^-'s, by π^+'s on beryllium nuclei, in the polar-angle range $20^\circ < \theta < 30^\circ$, for different π^+ beam momenta, as a function of the charge-signed p_T of the secondaries; the shown errors are total errors

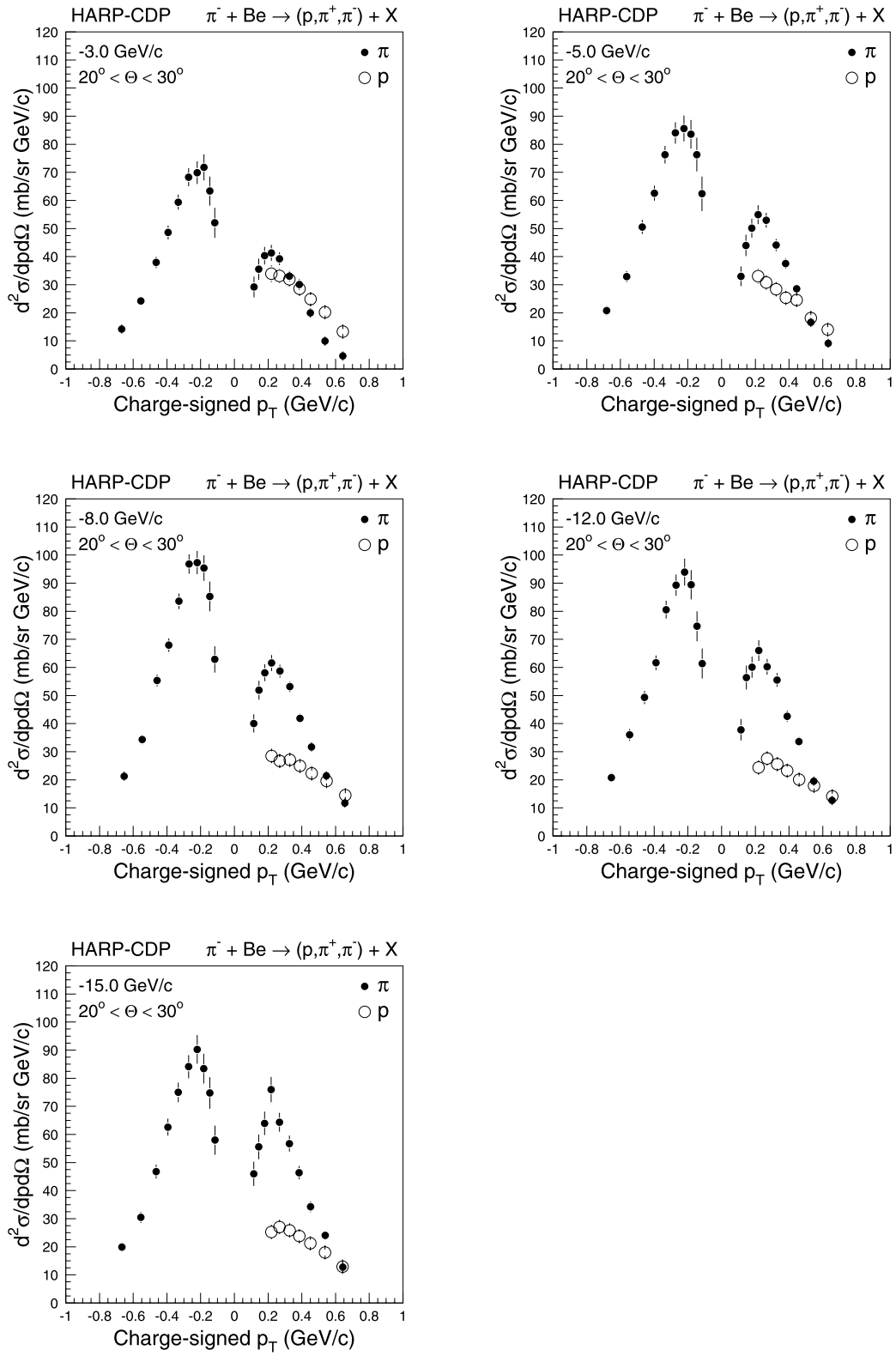

Fig. 3 Inclusive cross-sections of the production of secondary protons, π^+'s, and π^-'s, by π^-'s on beryllium nuclei, in the polar-angle range $20^\circ < \theta < 30^\circ$, for different π^- beam momenta, as a function of the charge-signed p_T of the secondaries; the shown errors are total errors

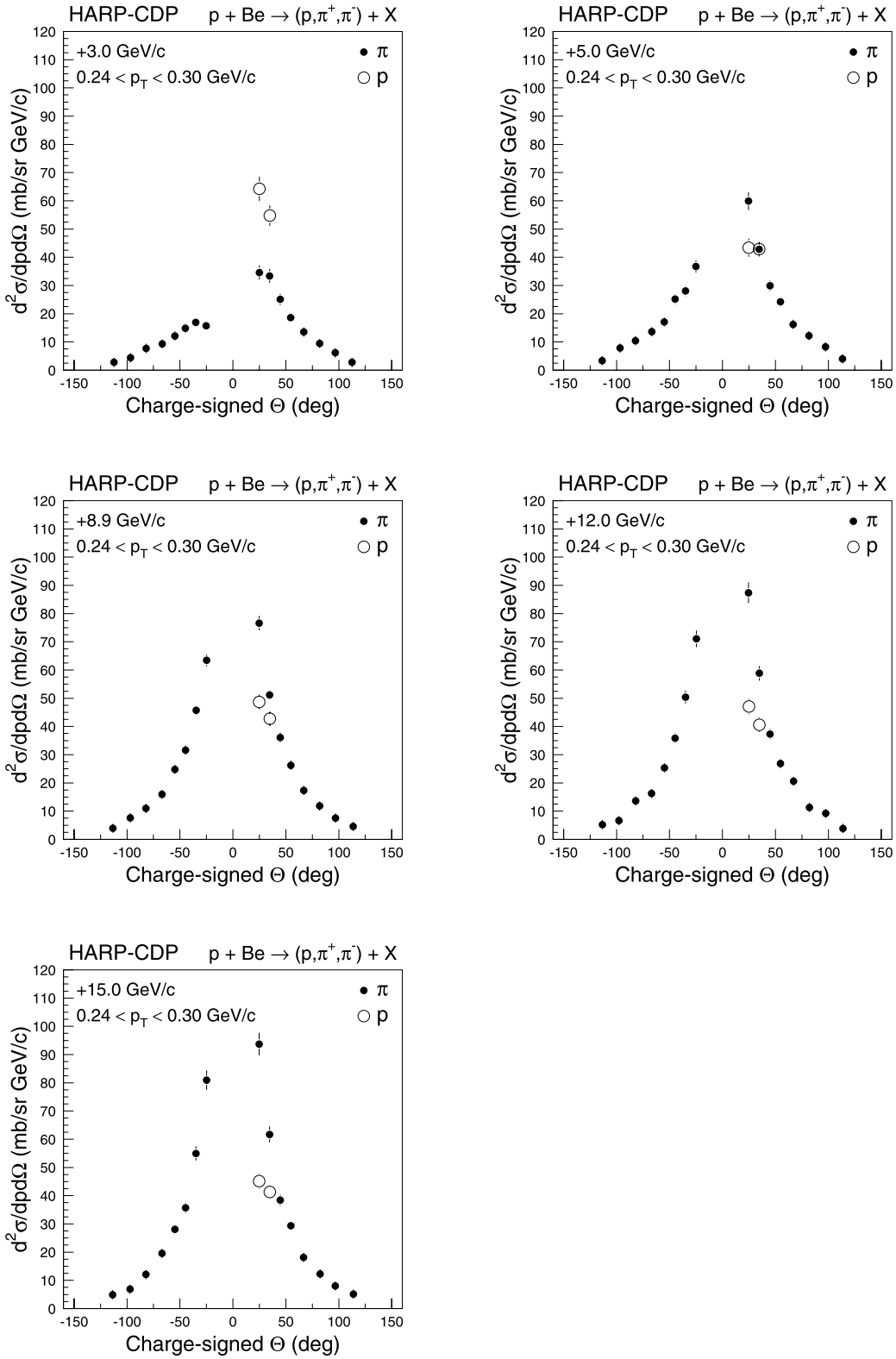

Fig. 4 Inclusive cross-sections of the production of secondary protons, π^+'s, and π^-'s, with p_{T} in the range 0.24–0.30 GeV/c, by protons on beryllium nuclei, for different proton beam momenta, as a function of the charge-signed polar angle θ of the secondaries; the shown errors are total errors

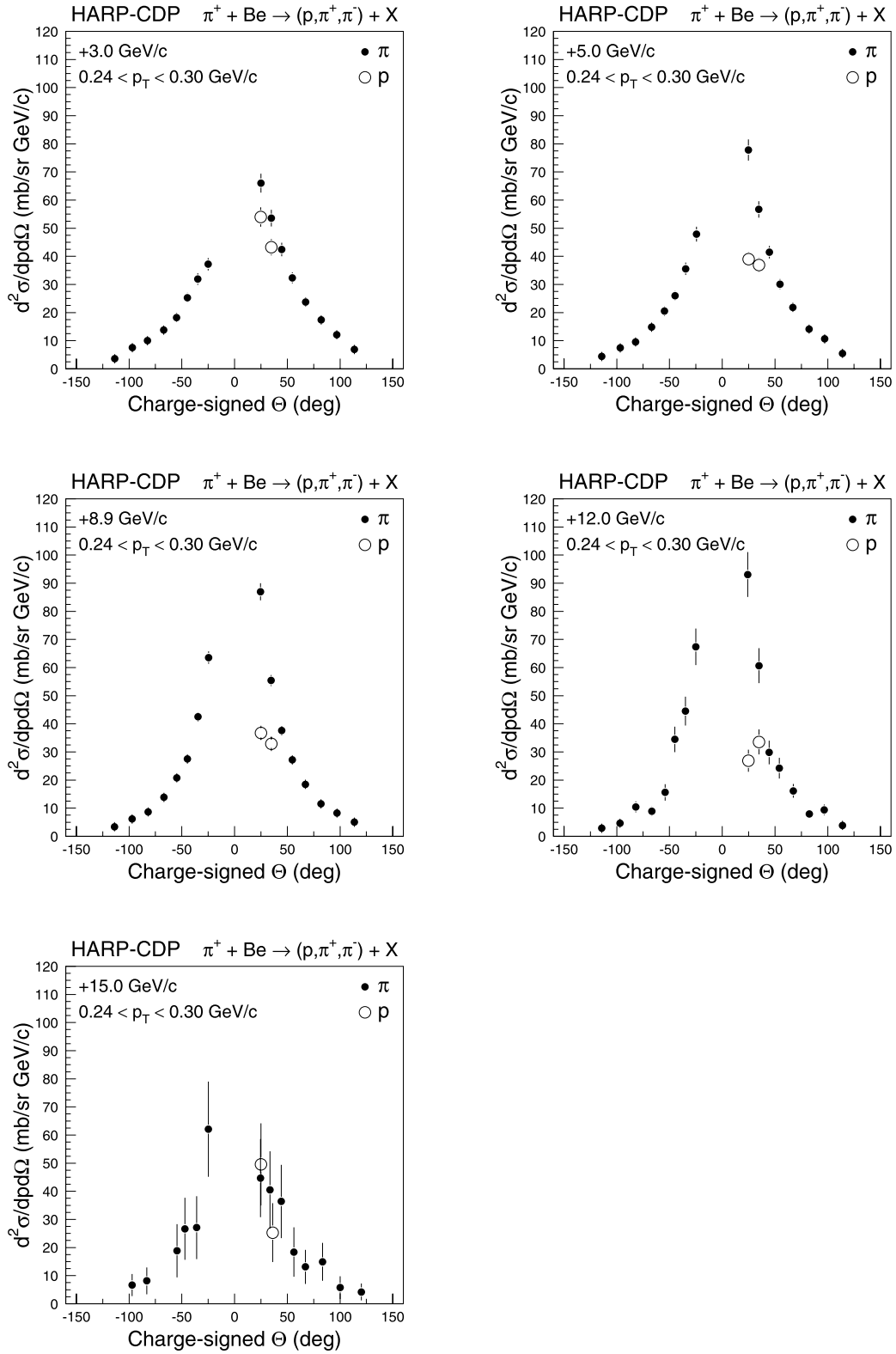

Fig. 5 Inclusive cross-sections of the production of secondary protons, π^+'s, and π^-'s, with p_{T} in the range 0.24–0.30 GeV/c, by π^+'s on beryllium nuclei, for different π^+ beam momenta, as a function of the charge-signed polar angle θ of the secondaries; the shown errors are total errors

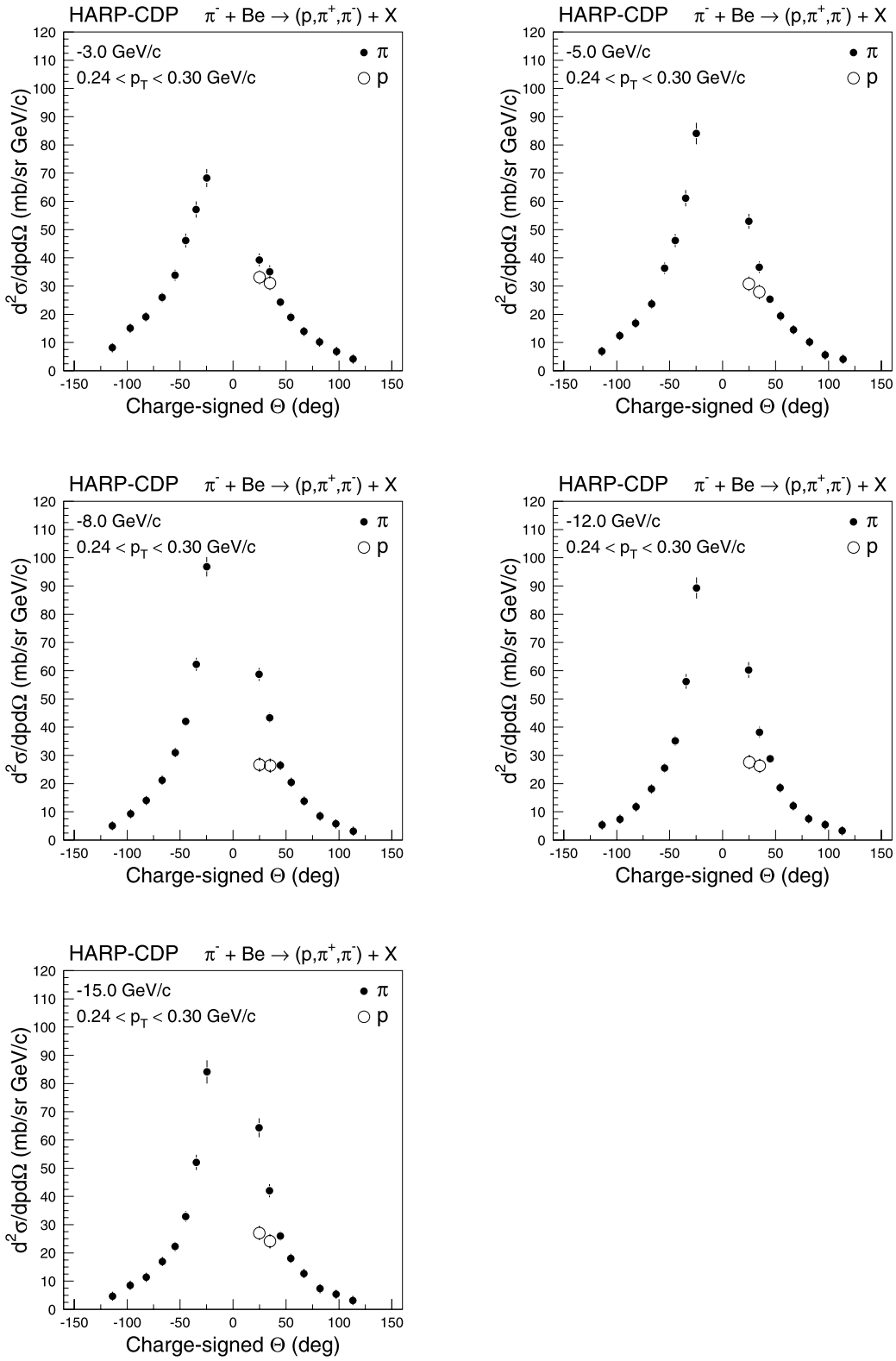

Fig. 6 Inclusive cross-sections of the production of secondary protons, π^+'s, and π^-'s, with p_{T} in the range 0.24–0.30 GeV/c, by π^-'s on beryllium nuclei, for different π^- beam momenta, as a function of the charge-signed polar angle θ of the secondaries; the shown errors are total errors

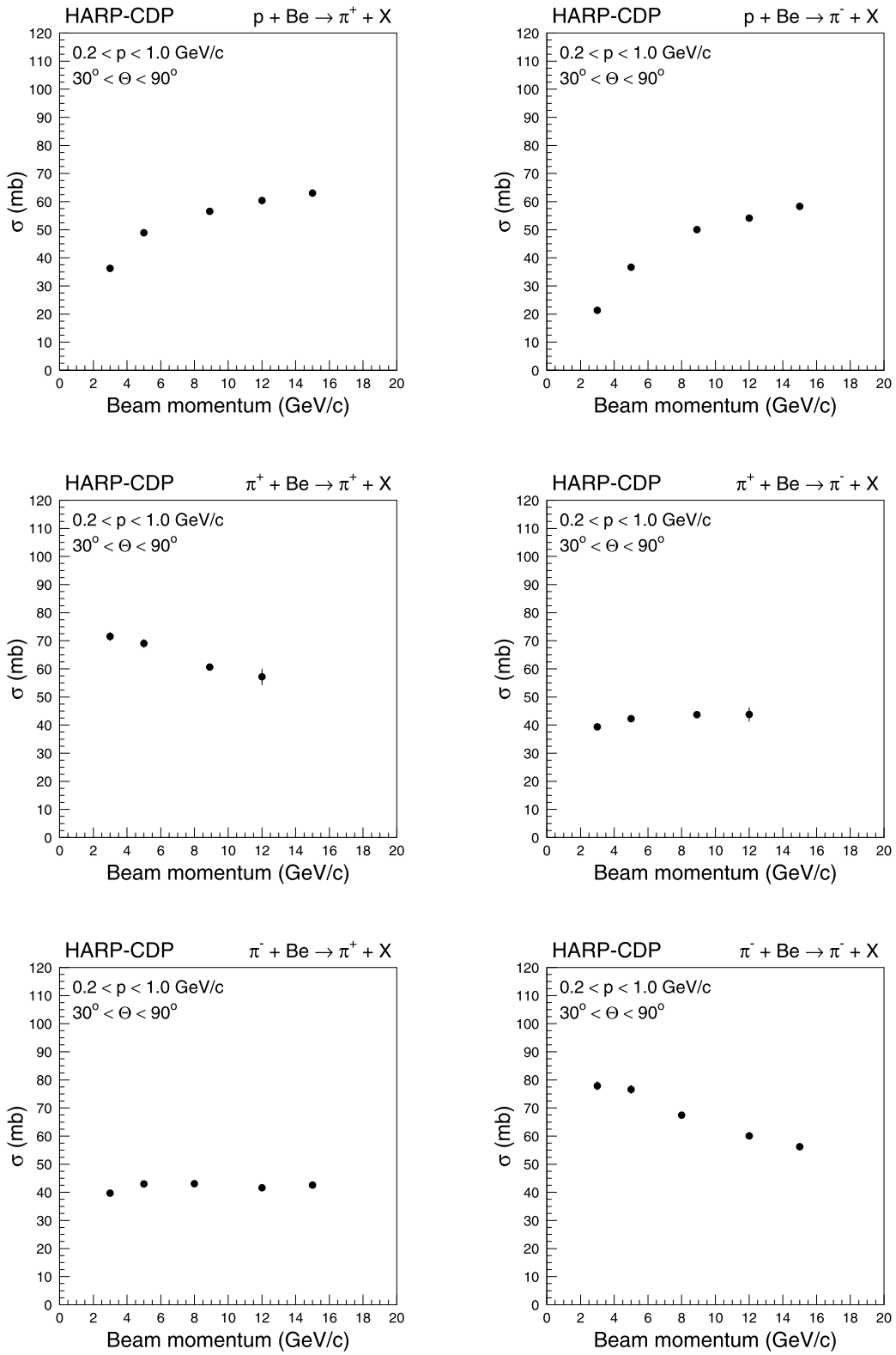

Fig. 7 Inclusive cross-sections of the production of secondary π^+'s and π^-'s, integrated over the momentum range $0.2 < p < 1.0$ GeV/c and the polar-angle range $30° < \theta < 90°$, from the interactions on beryllium nuclei of protons (*top row*), π^+'s (*middle row*), and π^-'s (*bottom row*), as a function of the beam momentum; the shown errors are total errors and mostly smaller than the symbol size

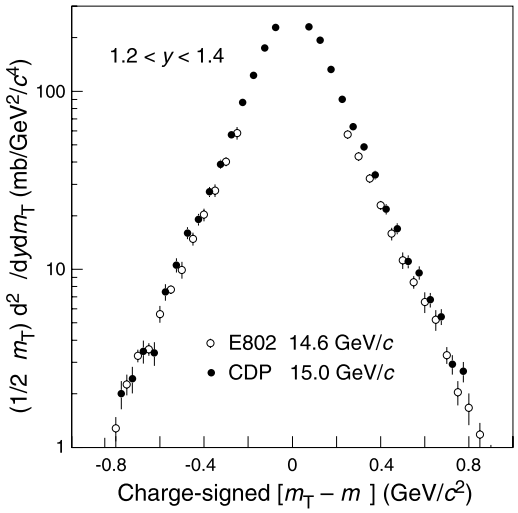

Fig. 8 Comparison of our cross-sections (*black circles*) of $\pi^{\pm}$ production by $+15.0$ GeV/c protons off beryllium nuclei, with the cross-sections published by the E802 Collaboration for the proton beam momentum of $+14.6$ GeV/c (*open circles*); all errors are statistical only

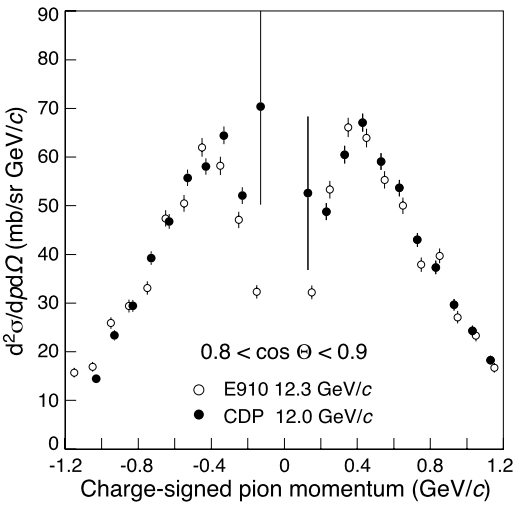

Fig. 9 Comparison of our cross-sections of $\pi^{\pm}$ production by $+12.0$ GeV/c protons off beryllium nuclei with the cross-sections published by the E910 Collaboration for the proton beam momentum of $+12.3$ GeV/c (*open circles*); all errors are statistical only

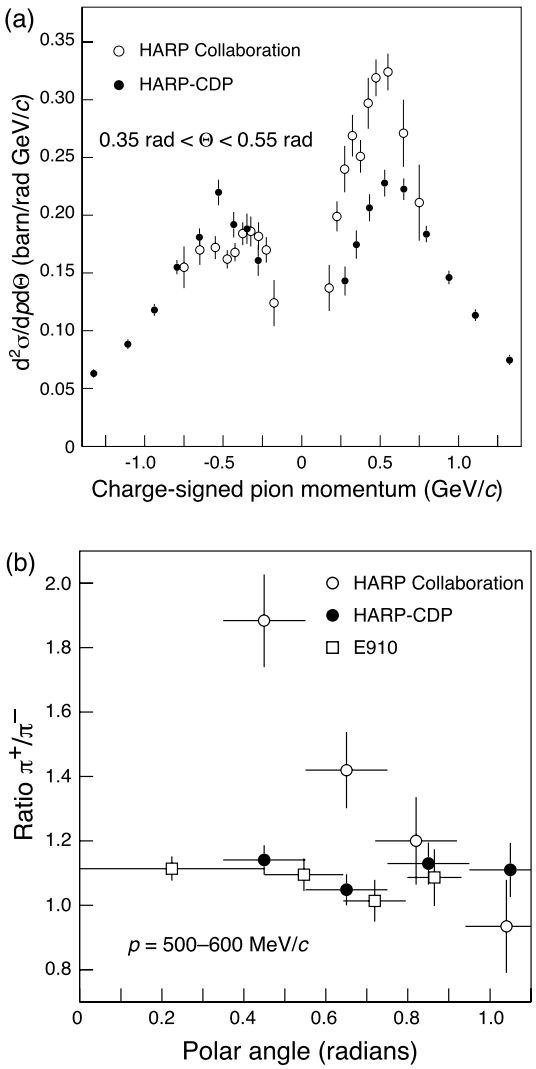

Fig. 10 (**a**) Comparison of our cross-sections (*black circles*) of $\pi^{\pm}$ production by $+12.0$ GeV/c protons off beryllium nuclei with the cross-sections published by the HARP Collaboration (*open circles*); (**b**) Comparison of our ratio π^+/π^- at $+12.0$ GeV/c beam momentum as a function of the polar angle θ with the ratios published by the HARP Collaboration; also shown are the ratios π^+/π^- published by the E910 Collaboration for a $+12.3$ GeV/c beam momentum; in (**a**) total errors are shown; in (**b**) for the HARP Collaboration total errors are shown (only those are published), for E910 and our group, the errors are statistical only

published by the E910 Collaboration (at the slightly different proton beam momentum of $+12.3$ GeV/c) and by the HARP Collaboration.

The discrepancy between our results and those published by the HARP Collaboration is evident. We note the difference especially of the π^+ cross-section, and the difference in the reported momentum range. The discrepancy is even more serious as the same data set has been analysed by both groups.

We hold that the discrepancy is caused by problems in the HARP Collaboration's data analysis. They result primarily, but not exclusively, from a lack of understanding TPC track distortions and RPC timing signals. These problems, together with others that affect the HARP Collaboration's data analysis, are discussed in detail in Refs. [4, 5, 21–23] and in the Appendix of Ref. [1].

8 Summary

From the analysis of data from the HARP large-angle spectrometer (polar angle θ in the range $20° < \theta < 125°$), double-differential cross-sections $\mathrm{d}^2\sigma/\mathrm{d}p\,\mathrm{d}\Omega$ of the production of secondary protons, π^+'s, and π^-'s, have been

obtained. The incoming beam particles were protons and pions with momenta from ±3 to ±15 GeV/c, impinging on a 5% λ_{abs} thick stationary beryllium target. Our cross-sections for π^+ and π^- production agree with results from the BNL experiments E802 and E910 but disagree with the results from the HARP Collaboration that were obtained from the same raw data.

Acknowledgements We are greatly indebted to many technical collaborators whose diligent and hard work made the HARP detector a well-functioning instrument. We thank all HARP colleagues who devoted time and effort to the design and construction of the detector, to data taking, and to setting up the computing and software infrastructure. We express our sincere gratitude to HARP's funding agencies for their support.

Appendix: Cross-section tables

Table A.1 Double-differential inclusive cross-section $d^2\sigma/dp\,d\Omega$ [mb/(GeV/c sr)] of the production of protons in p + Be → p + X interactions with +3.0 GeV/c beam momentum; the first error is statistical, the second systematic; p_T in GeV/c, polar angle θ in degrees

p_T	$20 < \theta < 30$							$30 < \theta < 40$						
	$\langle p_T \rangle$	$\langle \theta \rangle$	$d^2\sigma/dp\,d\Omega$					$\langle p_T \rangle$	$\langle \theta \rangle$	$d^2\sigma/dp\,d\Omega$				
0.20–0.24	0.221	24.7	58.52	±	2.79	±	3.92							
0.24–0.30	0.269	25.1	64.24	±	2.38	±	3.63	0.271	34.9	54.76	±	2.16	±	2.96
0.30–0.36	0.329	24.9	58.05	±	2.24	±	2.98	0.330	35.1	51.23	±	2.05	±	2.50
0.36–0.42	0.390	24.9	57.81	±	2.23	±	2.75	0.390	34.9	52.43	±	2.11	±	2.44
0.42–0.50	0.459	24.8	54.37	±	1.85	±	2.27	0.460	34.9	43.86	±	1.69	±	1.83
0.50–0.60	0.548	24.8	43.78	±	1.50	±	1.80	0.549	34.8	35.55	±	1.37	±	1.47
0.60–0.72	0.656	24.8	35.71	±	1.28	±	1.73	0.654	34.9	24.47	±	1.03	±	1.26
0.72–0.90								0.800	35.0	16.01	±	0.71	±	1.08
p_T	$40 < \theta < 50$							$50 < \theta < 60$						
	$\langle p_T \rangle$	$\langle \theta \rangle$	$d^2\sigma/dp\,d\Omega$					$\langle p_T \rangle$	$\langle \theta \rangle$	$d^2\sigma/dp\,d\Omega$				
0.30–0.36	0.332	45.0	45.49	±	1.88	±	2.08							
0.36–0.42	0.391	45.0	46.83	±	1.96	±	2.13	0.390	55.1	41.48	±	1.80	±	1.82
0.42–0.50	0.461	45.1	37.82	±	1.52	±	1.55	0.461	55.3	35.87	±	1.47	±	1.49
0.50–0.60	0.551	45.0	33.10	±	1.32	±	1.44	0.551	55.0	32.08	±	1.27	±	1.42
0.60–0.72	0.659	44.9	27.41	±	1.14	±	1.42	0.663	55.2	24.47	±	1.08	±	1.41
0.72–0.90	0.806	44.9	13.53	±	0.64	±	0.96	0.803	54.7	12.21	±	0.63	±	1.00
0.90–1.25	1.037	44.8	2.97	±	0.20	±	0.46	1.030	54.7	1.69	±	0.14	±	0.32
p_T	$60 < \theta < 75$							$75 < \theta < 90$						
	$\langle p_T \rangle$	$\langle \theta \rangle$	$d^2\sigma/dp\,d\Omega$					$\langle p_T \rangle$	$\langle \theta \rangle$	$d^2\sigma/dp\,d\Omega$				
0.36–0.42	0.391	67.3	40.49	±	1.46	±	1.60							
0.42–0.50	0.460	67.2	35.62	±	1.20	±	1.31	0.459	81.5	20.38	±	0.89	±	0.97
0.50–0.60	0.549	67.1	30.01	±	1.01	±	1.33	0.547	81.4	13.19	±	0.65	±	0.81
0.60–0.72	0.660	66.9	14.59	±	0.65	±	0.94	0.660	81.3	6.31	±	0.44	±	0.69
0.72–0.90	0.803	66.4	5.20	±	0.32	±	0.57	0.791	81.4	1.68	±	0.19	±	0.26
0.90–1.25	1.027	66.1	0.67	±	0.08	±	0.17	1.031	81.5	0.17	±	0.04	±	0.09
p_T	$90 < \theta < 105$							$105 < \theta < 125$						
	$\langle p_T \rangle$	$\langle \theta \rangle$	$d^2\sigma/dp\,d\Omega$					$\langle p_T \rangle$	$\langle \theta \rangle$	$d^2\sigma/dp\,d\Omega$				
0.36–0.42								0.389	113.6	6.77	±	0.48	±	0.51
0.42–0.50	0.458	96.5	10.78	±	0.64	±	0.79	0.456	113.0	4.70	±	0.36	±	0.40
0.50–0.60	0.549	96.0	5.78	±	0.42	±	0.52	0.539	111.7	1.45	±	0.20	±	0.21
0.60–0.72	0.659	95.5	1.58	±	0.23	±	0.23	0.659	112.3	0.23	±	0.08	±	0.08
0.72–0.90	0.785	94.8	0.38	±	0.11	±	0.12							

Table A.2 Double-differential inclusive cross-section $d^2\sigma/dp\,d\Omega$ [mb/(GeV/c sr)] of the production of π^+'s in p + Be $\rightarrow \pi^+ +$ X interactions with +3.0 GeV/c beam momentum; the first error is statistical, the second systematic; p_T in GeV/c, polar angle θ in degrees

p_T	$20 < \theta < 30$							$30 < \theta < 40$						
	$\langle p_T \rangle$	$\langle \theta \rangle$	$d^2\sigma/dp\,d\Omega$					$\langle p_T \rangle$	$\langle \theta \rangle$	$d^2\sigma/dp\,d\Omega$				
0.10–0.13	0.116	24.5	26.72	±	2.52	±	2.91	0.113	35.8	25.91	±	2.50	±	3.03
0.13–0.16	0.146	24.6	38.71	±	2.79	±	3.07	0.146	34.7	34.51	±	2.55	±	2.95
0.16–0.20	0.180	25.0	54.17	±	2.77	±	3.39	0.179	34.5	36.55	±	2.23	±	2.41
0.20–0.24	0.220	24.9	52.69	±	2.68	±	3.04	0.220	34.8	39.25	±	2.24	±	2.35
0.24–0.30	0.269	25.0	34.60	±	1.75	±	1.83	0.268	34.6	33.40	±	1.69	±	1.72
0.30–0.36	0.328	25.3	27.87	±	1.58	±	1.53	0.329	35.2	24.06	±	1.44	±	1.35
0.36–0.42	0.388	25.0	16.61	±	1.17	±	1.18	0.386	35.1	16.13	±	1.16	±	1.04
0.42–0.50	0.458	25.1	11.44	±	0.83	±	0.77	0.458	34.8	9.70	±	0.79	±	0.65
0.50–0.60	0.548	25.0	4.88	±	0.44	±	0.45	0.549	34.9	5.58	±	0.50	±	0.46
0.60–0.72	0.656	24.9	3.72	±	0.33	±	0.58	0.654	35.3	3.21	±	0.34	±	0.40
0.72–0.90								0.798	34.7	1.73	±	0.18	±	0.59
p_T	$40 < \theta < 50$							$50 < \theta < 60$						
	$\langle p_T \rangle$	$\langle \theta \rangle$	$d^2\sigma/dp\,d\Omega$					$\langle p_T \rangle$	$\langle \theta \rangle$	$d^2\sigma/dp\,d\Omega$				
0.10–0.13	0.116	45.4	20.82	±	2.28	±	2.40							
0.13–0.16	0.146	45.0	27.15	±	2.32	±	2.26	0.145	54.4	27.70	±	2.42	±	2.54
0.16–0.20	0.180	45.0	35.34	±	2.19	±	2.32	0.180	55.0	29.59	±	2.06	±	2.05
0.20–0.24	0.219	44.4	32.30	±	2.05	±	2.01	0.220	54.7	26.36	±	1.87	±	1.73
0.24–0.30	0.271	44.6	25.09	±	1.47	±	1.44	0.269	54.5	18.60	±	1.27	±	1.13
0.30–0.36	0.329	44.6	18.15	±	1.23	±	1.10	0.330	54.6	13.68	±	1.08	±	0.92
0.36–0.42	0.391	44.7	12.60	±	1.02	±	0.86	0.389	54.1	9.64	±	0.91	±	0.75
0.42–0.50	0.457	44.9	8.79	±	0.77	±	0.63	0.460	54.7	6.56	±	0.66	±	0.54
0.50–0.60	0.544	45.1	3.35	±	0.41	±	0.29	0.548	54.1	3.39	±	0.41	±	0.33
0.60–0.72	0.649	44.4	2.43	±	0.31	±	0.33	0.658	54.2	2.39	±	0.32	±	0.36
0.72–0.90	0.806	44.0	1.24	±	0.17	±	0.33	0.800	53.9	0.61	±	0.12	±	0.17
0.90–1.25								1.048	54.2	0.14	±	0.03	±	0.04
p_T	$60 < \theta < 75$							$75 < \theta < 90$						
	$\langle p_T \rangle$	$\langle \theta \rangle$	$d^2\sigma/dp\,d\Omega$					$\langle p_T \rangle$	$\langle \theta \rangle$	$d^2\sigma/dp\,d\Omega$				
0.13–0.16	0.145	67.5	19.57	±	1.66	±	1.71	0.148	82.6	19.65	±	1.65	±	1.89
0.16–0.20	0.180	67.5	21.09	±	1.41	±	1.39	0.181	82.0	18.85	±	1.33	±	1.34
0.20–0.24	0.221	67.3	20.59	±	1.36	±	1.29	0.218	81.8	14.36	±	1.15	±	0.98
0.24–0.30	0.269	67.0	13.53	±	0.88	±	0.76	0.268	81.8	9.46	±	0.75	±	0.64
0.30–0.36	0.329	66.6	8.32	±	0.69	±	0.53	0.328	81.6	7.00	±	0.64	±	0.57
0.36–0.42	0.390	66.8	7.22	±	0.65	±	0.58	0.390	81.8	4.34	±	0.50	±	0.45
0.42–0.50	0.461	66.4	3.92	±	0.41	±	0.33	0.460	81.5	2.48	±	0.32	±	0.27
0.50–0.60	0.549	66.7	2.49	±	0.29	±	0.26	0.551	80.6	1.18	±	0.20	±	0.17
0.60–0.72	0.659	67.0	1.01	±	0.17	±	0.16	0.645	82.4	0.26	±	0.08	±	0.08
0.72–0.90	0.803	66.0	0.34	±	0.08	±	0.11	0.807	82.7	0.09	±	0.03	±	0.06
p_T	$90 < \theta < 105$							$105 < \theta < 125$						
	$\langle p_T \rangle$	$\langle \theta \rangle$	$d^2\sigma/dp\,d\Omega$					$\langle p_T \rangle$	$\langle \theta \rangle$	$d^2\sigma/dp\,d\Omega$				
0.13–0.16	0.145	97.6	14.79	±	1.42	±	1.45	0.144	114.7	12.72	±	1.16	±	1.10
0.16–0.20	0.183	97.8	15.13	±	1.19	±	1.14	0.180	113.6	10.23	±	0.86	±	0.68
0.20–0.24	0.218	97.3	11.01	±	1.01	±	0.87	0.218	113.2	7.25	±	0.71	±	0.61
0.24–0.30	0.264	96.7	6.15	±	0.61	±	0.49	0.267	112.5	2.79	±	0.36	±	0.28
0.30–0.36	0.330	96.6	3.62	±	0.46	±	0.39	0.327	112.6	1.16	±	0.23	±	0.18
0.36–0.42	0.386	96.2	2.62	±	0.40	±	0.36	0.400	112.8	0.83	±	0.19	±	0.18
0.42–0.50	0.457	95.5	0.87	±	0.19	±	0.15	0.454	113.8	0.33	±	0.10	±	0.11
0.50–0.60	0.548	96.3	0.40	±	0.11	±	0.11							
0.60–0.72	0.662	92.0	0.11	±	0.05	±	0.06							

Table A.3 Double-differential inclusive cross-section $d^2\sigma/dp\,d\Omega$ [mb/(GeV/c sr)] of the production of π^-'s in p + Be $\rightarrow \pi^-$ + X interactions with +3.0 GeV/c beam momentum; the first error is statistical, the second systematic; p_T in GeV/c, polar angle θ in degrees

p_T	$20 < \theta < 30$							$30 < \theta < 40$						
	$\langle p_T \rangle$	$\langle \theta \rangle$	$d^2\sigma/dp\,d\Omega$					$\langle p_T \rangle$	$\langle \theta \rangle$	$d^2\sigma/dp\,d\Omega$				
0.10–0.13	0.115	25.5	17.40	±	2.00	±	2.06	0.115	34.5	19.48	±	2.02	±	2.28
0.13–0.16	0.145	24.7	24.57	±	2.20	±	2.55	0.146	34.3	17.52	±	1.79	±	1.73
0.16–0.20	0.179	24.9	23.25	±	1.76	±	1.91	0.181	34.9	19.27	±	1.55	±	1.57
0.20–0.24	0.220	24.9	21.48	±	1.70	±	1.69	0.219	34.7	22.12	±	1.69	±	1.65
0.24–0.30	0.268	25.2	15.72	±	1.18	±	1.09	0.270	35.0	16.90	±	1.19	±	1.17
0.30–0.36	0.327	25.2	9.18	±	0.90	±	0.73	0.330	34.8	11.79	±	0.99	±	0.85
0.36–0.42	0.391	24.7	5.31	±	0.68	±	0.54	0.390	35.3	7.60	±	0.81	±	0.66
0.42–0.50	0.453	25.4	4.17	±	0.53	±	0.47	0.461	34.8	3.53	±	0.48	±	0.37
0.50–0.60	0.537	26.2	1.39	±	0.27	±	0.24	0.551	34.8	2.62	±	0.37	±	0.37
0.60–0.72	0.645	24.9	0.38	±	0.13	±	0.12	0.647	35.5	1.07	±	0.22	±	0.24
0.72–0.90								0.767	36.4	0.25	±	0.09	±	0.13
p_T	$40 < \theta < 50$							$50 < \theta < 60$						
	$\langle p_T \rangle$	$\langle \theta \rangle$	$d^2\sigma/dp\,d\Omega$					$\langle p_T \rangle$	$\langle \theta \rangle$	$d^2\sigma/dp\,d\Omega$				
0.10–0.13	0.117	44.8	16.25	±	1.94	±	2.09							
0.13–0.16	0.144	45.1	16.74	±	1.81	±	1.69	0.146	54.6	18.91	±	1.96	±	1.99
0.16–0.20	0.177	45.1	17.69	±	1.54	±	1.46	0.180	54.9	18.49	±	1.56	±	1.49
0.20–0.24	0.219	44.8	19.00	±	1.57	±	1.55	0.221	55.3	16.17	±	1.48	±	1.30
0.24–0.30	0.270	44.9	14.87	±	1.12	±	1.01	0.266	54.7	12.13	±	1.02	±	0.89
0.30–0.36	0.328	45.0	11.85	±	1.01	±	0.94	0.326	54.8	9.51	±	0.90	±	0.76
0.36–0.42	0.387	44.7	6.06	±	0.70	±	0.54	0.388	54.9	7.13	±	0.79	±	0.68
0.42–0.50	0.455	44.5	4.13	±	0.52	±	0.41	0.454	55.2	4.28	±	0.53	±	0.45
0.50–0.60	0.537	45.0	1.98	±	0.32	±	0.25	0.540	54.7	1.37	±	0.27	±	0.19
0.60–0.72	0.654	45.0	0.87	±	0.20	±	0.19	0.650	55.0	1.12	±	0.22	±	0.26
0.72–0.90	0.762	43.3	0.16	±	0.07	±	0.09	0.765	54.8	0.19	±	0.08	±	0.09
p_T	$60 < \theta < 75$							$75 < \theta < 90$						
	$\langle p_T \rangle$	$\langle \theta \rangle$	$d^2\sigma/dp\,d\Omega$					$\langle p_T \rangle$	$\langle \theta \rangle$	$d^2\sigma/dp\,d\Omega$				
0.13–0.16	0.146	67.5	15.69	±	1.47	±	1.52	0.145	82.9	14.31	±	1.42	±	1.42
0.16–0.20	0.178	67.3	14.06	±	1.15	±	1.05	0.179	82.1	14.32	±	1.17	±	1.14
0.20–0.24	0.219	67.2	13.56	±	1.10	±	0.98	0.217	82.3	11.87	±	1.03	±	0.96
0.24–0.30	0.268	66.8	9.30	±	0.73	±	0.63	0.266	82.0	7.73	±	0.68	±	0.61
0.30–0.36	0.326	65.8	7.61	±	0.67	±	0.57	0.325	82.1	3.93	±	0.48	±	0.44
0.36–0.42	0.387	67.0	3.96	±	0.48	±	0.36	0.382	81.7	2.65	±	0.40	±	0.32
0.42–0.50	0.450	66.6	2.56	±	0.33	±	0.28	0.459	82.6	1.49	±	0.25	±	0.22
0.50–0.60	0.543	66.6	1.35	±	0.22	±	0.18	0.546	83.1	0.63	±	0.15	±	0.13
0.60–0.72	0.633	66.6	0.42	±	0.11	±	0.11	0.647	78.0	0.12	±	0.06	±	0.05
p_T	$90 < \theta < 105$							$105 < \theta < 125$						
	$\langle p_T \rangle$	$\langle \theta \rangle$	$d^2\sigma/dp\,d\Omega$					$\langle p_T \rangle$	$\langle \theta \rangle$	$d^2\sigma/dp\,d\Omega$				
0.13–0.16	0.145	97.8	11.43	±	1.24	±	1.16	0.143	115.3	12.45	±	1.13	±	1.11
0.16–0.20	0.178	97.2	13.43	±	1.12	±	1.08	0.178	113.6	9.85	±	0.84	±	0.75
0.20–0.24	0.216	96.8	7.62	±	0.85	±	0.72	0.218	114.0	3.92	±	0.52	±	0.41
0.24–0.30	0.265	96.7	4.37	±	0.52	±	0.45	0.266	112.3	2.80	±	0.36	±	0.35
0.30–0.36	0.329	96.6	2.98	±	0.42	±	0.44	0.329	111.3	1.37	±	0.25	±	0.24
0.36–0.42	0.393	96.4	0.98	±	0.24	±	0.18	0.388	112.6	0.48	±	0.14	±	0.13
0.42–0.50	0.445	97.7	0.98	±	0.21	±	0.23	0.468	114.6	0.18	±	0.07	±	0.07
0.50–0.60	0.545	97.1	0.31	±	0.10	±	0.16							

Table A.4 Double-differential inclusive cross-section $d^2\sigma/dp\,d\Omega$ [mb/(GeV/c sr)] of the production of protons in $\pi^+ + \mathrm{Be} \to \mathrm{p} + \mathrm{X}$ interactions with +3.0 GeV/c beam momentum; the first error is statistical, the second systematic; p_T in GeV/c, polar angle θ in degrees

p_T	$20 < \theta < 30$							$30 < \theta < 40$						
	$\langle p_\mathrm{T}\rangle$	$\langle\theta\rangle$	$d^2\sigma/dp\,d\Omega$					$\langle p_\mathrm{T}\rangle$	$\langle\theta\rangle$	$d^2\sigma/dp\,d\Omega$				
0.20–0.24	0.220	24.9	50.34	±	1.88	±	3.48							
0.24–0.30	0.271	24.9	53.95	±	1.58	±	3.07	0.270	34.9	43.21	±	1.37	±	2.53
0.30–0.36	0.330	24.9	47.07	±	1.46	±	2.45	0.329	35.1	43.86	±	1.37	±	2.23
0.36–0.42	0.390	25.1	42.80	±	1.37	±	2.06	0.389	34.9	38.22	±	1.30	±	1.77
0.42–0.50	0.460	24.9	39.00	±	1.11	±	1.73	0.459	34.9	36.01	±	1.10	±	1.48
0.50–0.60	0.549	25.0	32.73	±	0.91	±	1.38	0.547	35.0	31.06	±	0.91	±	1.31
0.60–0.72	0.655	25.1	24.05	±	0.73	±	1.26	0.654	34.8	21.63	±	0.68	±	1.10
0.72–0.90								0.799	35.0	14.33	±	0.47	±	0.97
p_T	$40 < \theta < 50$							$50 < \theta < 60$						
	$\langle p_\mathrm{T}\rangle$	$\langle\theta\rangle$	$d^2\sigma/dp\,d\Omega$					$\langle p_\mathrm{T}\rangle$	$\langle\theta\rangle$	$d^2\sigma/dp\,d\Omega$				
0.30–0.36	0.331	44.9	40.03	±	1.27	±	2.00							
0.36–0.42	0.390	44.9	38.72	±	1.29	±	1.78	0.392	55.0	34.14	±	1.18	±	1.68
0.42–0.50	0.461	45.2	30.71	±	1.00	±	1.31	0.461	54.9	28.83	±	0.95	±	1.26
0.50–0.60	0.551	44.9	26.80	±	0.86	±	1.14	0.549	54.9	22.78	±	0.78	±	1.08
0.60–0.72	0.659	45.0	20.70	±	0.71	±	1.15	0.658	55.0	17.89	±	0.67	±	1.06
0.72–0.90	0.804	45.2	11.04	±	0.41	±	0.77	0.804	54.9	9.14	±	0.39	±	0.67
0.90–1.25	1.040	45.0	2.59	±	0.13	±	0.30	1.035	54.6	1.45	±	0.09	±	0.21
p_T	$60 < \theta < 75$							$75 < \theta < 90$						
	$\langle p_\mathrm{T}\rangle$	$\langle\theta\rangle$	$d^2\sigma/dp\,d\Omega$					$\langle p_\mathrm{T}\rangle$	$\langle\theta\rangle$	$d^2\sigma/dp\,d\Omega$				
0.36–0.42	0.391	67.4	32.41	±	0.95	±	1.35							
0.42–0.50	0.461	67.3	28.38	±	0.78	±	1.06	0.460	81.9	19.96	±	0.65	±	1.00
0.50–0.60	0.549	67.0	22.20	±	0.63	±	1.01	0.548	82.0	12.18	±	0.45	±	0.77
0.60–0.72	0.658	67.0	11.22	±	0.41	±	0.73	0.655	81.4	5.92	±	0.30	±	0.52
0.72–0.90	0.803	66.7	4.69	±	0.22	±	0.46	0.804	82.2	2.17	±	0.15	±	0.29
0.90–1.25	1.041	66.8	0.71	±	0.06	±	0.14	1.035	81.3	0.24	±	0.04	±	0.06
p_T	$90 < \theta < 105$							$105 < \theta < 125$						
	$\langle p_\mathrm{T}\rangle$	$\langle\theta\rangle$	$d^2\sigma/dp\,d\Omega$					$\langle p_\mathrm{T}\rangle$	$\langle\theta\rangle$	$d^2\sigma/dp\,d\Omega$				
0.36–0.42								0.389	114.0	8.63	±	0.40	±	0.61
0.42–0.50	0.459	97.0	12.05	±	0.50	±	0.88	0.459	113.8	5.58	±	0.29	±	0.45
0.50–0.60	0.546	96.7	6.52	±	0.32	±	0.56	0.544	113.0	2.68	±	0.19	±	0.31
0.60–0.72	0.658	96.4	2.78	±	0.20	±	0.34	0.649	113.3	0.52	±	0.08	±	0.11
0.72–0.90	0.798	95.9	0.68	±	0.09	±	0.13	0.794	111.5	0.09	±	0.03	±	0.04
0.90–1.25	1.018	95.4	0.05	±	0.02	±	0.04							

Table A.5 Double-differential inclusive cross-section $d^2\sigma/dp\,d\Omega$ [mb/(GeV/c sr)] of the production of π^+'s in $\pi^+ + \mathrm{Be} \to \pi^+ + \mathrm{X}$ interactions with +3.0 GeV/c beam momentum; the first error is statistical, the second systematic; p_T in GeV/c, polar angle θ in degrees

p_T	$20 < \theta < 30$							$30 < \theta < 40$						
	$\langle p_\mathrm{T}\rangle$	$\langle\theta\rangle$	$d^2\sigma/dp\,d\Omega$					$\langle p_\mathrm{T}\rangle$	$\langle\theta\rangle$	$d^2\sigma/dp\,d\Omega$				
0.10–0.13	0.115	24.8	43.47	±	2.34	±	4.31	0.115	34.9	33.36	±	2.01	±	3.40
0.13–0.16	0.145	24.8	50.46	±	2.29	±	3.82	0.146	34.5	36.70	±	1.89	±	2.97
0.16–0.20	0.181	24.7	64.45	±	2.17	±	3.95	0.181	34.9	47.62	±	1.84	±	3.14
0.20–0.24	0.220	24.8	67.24	±	2.18	±	3.57	0.220	34.7	55.06	±	1.92	±	3.08
0.24–0.30	0.270	24.9	66.04	±	1.76	±	2.86	0.270	34.8	53.58	±	1.55	±	2.50
0.30–0.36	0.329	24.9	59.60	±	1.66	±	2.52	0.329	34.8	47.63	±	1.46	±	2.11
0.36–0.42	0.389	24.9	47.34	±	1.46	±	1.99	0.389	34.7	36.43	±	1.26	±	1.64
0.42–0.50	0.460	25.0	35.97	±	1.08	±	1.66	0.458	34.9	32.72	±	1.05	±	1.51
0.50–0.60	0.548	24.9	24.39	±	0.76	±	1.47	0.547	35.0	20.98	±	0.72	±	1.21
0.60–0.72	0.657	25.0	17.10	±	0.60	±	1.49	0.654	34.9	13.91	±	0.53	±	1.12
0.72–0.90								0.798	34.7	9.18	±	0.37	±	1.12
p_T	$40 < \theta < 50$							$50 < \theta < 60$						
	$\langle p_\mathrm{T}\rangle$	$\langle\theta\rangle$	$d^2\sigma/dp\,d\Omega$					$\langle p_\mathrm{T}\rangle$	$\langle\theta\rangle$	$d^2\sigma/dp\,d\Omega$				
0.10–0.13	0.116	45.0	32.76	±	2.06	±	3.31							
0.13–0.16	0.146	44.7	38.57	±	2.00	±	3.15	0.145	54.9	32.66	±	1.91	±	2.70
0.16–0.20	0.181	44.7	38.32	±	1.65	±	2.58	0.180	54.8	35.10	±	1.63	±	2.29
0.20–0.24	0.220	44.8	40.72	±	1.67	±	2.39	0.220	54.5	33.05	±	1.51	±	2.00
0.24–0.30	0.271	44.8	42.43	±	1.38	±	2.01	0.270	54.7	32.36	±	1.22	±	1.57
0.30–0.36	0.331	44.6	33.97	±	1.21	±	1.55	0.331	54.7	27.80	±	1.12	±	1.28
0.36–0.42	0.391	44.7	29.63	±	1.14	±	1.41	0.390	54.9	24.49	±	1.06	±	1.18
0.42–0.50	0.460	44.7	24.72	±	0.93	±	1.18	0.461	54.9	18.68	±	0.80	±	1.00
0.50–0.60	0.551	44.7	17.94	±	0.69	±	1.06	0.550	54.7	13.98	±	0.61	±	0.90
0.60–0.72	0.662	44.6	12.72	±	0.53	±	0.97	0.660	54.6	8.57	±	0.44	±	0.72
0.72–0.90	0.802	44.5	6.08	±	0.30	±	0.67	0.800	54.7	4.44	±	0.27	±	0.50
0.90–1.25								1.026	54.3	0.69	±	0.06	±	0.14
p_T	$60 < \theta < 75$							$75 < \theta < 90$						
	$\langle p_\mathrm{T}\rangle$	$\langle\theta\rangle$	$d^2\sigma/dp\,d\Omega$					$\langle p_\mathrm{T}\rangle$	$\langle\theta\rangle$	$d^2\sigma/dp\,d\Omega$				
0.13–0.16	0.146	67.2	27.36	±	1.41	±	2.13	0.145	82.3	23.85	±	1.33	±	1.95
0.16–0.20	0.180	67.4	32.26	±	1.27	±	1.96	0.181	82.2	27.84	±	1.17	±	1.73
0.20–0.24	0.220	67.5	28.37	±	1.15	±	1.62	0.219	82.1	22.35	±	1.04	±	1.36
0.24–0.30	0.270	67.3	23.71	±	0.86	±	1.13	0.269	82.1	17.37	±	0.74	±	0.91
0.30–0.36	0.331	67.2	20.19	±	0.79	±	0.93	0.331	81.5	12.76	±	0.63	±	0.71
0.36–0.42	0.392	67.1	16.77	±	0.73	±	0.82	0.389	81.1	10.39	±	0.57	±	0.68
0.42–0.50	0.461	66.9	12.41	±	0.53	±	0.71	0.460	82.3	6.55	±	0.39	±	0.51
0.50–0.60	0.550	66.4	8.58	±	0.39	±	0.63	0.552	82.0	4.47	±	0.29	±	0.44
0.60–0.72	0.659	66.6	4.59	±	0.27	±	0.47	0.658	81.5	2.01	±	0.17	±	0.27
0.72–0.90	0.793	66.1	1.75	±	0.13	±	0.24	0.809	81.6	0.56	±	0.06	±	0.12
0.90–1.25	1.029	66.0	0.20	±	0.02	±	0.05	1.035	82.4	0.05	±	0.01	±	0.03

Table A.5 (*Continued*)

p_T	$90 < \theta < 105$							$105 < \theta < 125$						
	$\langle p_T \rangle$	$\langle \theta \rangle$	$d^2\sigma/dp\,d\Omega$					$\langle p_T \rangle$	$\langle \theta \rangle$	$d^2\sigma/dp\,d\Omega$				
0.13–0.16	0.146	97.0	19.93	±	1.20	±	1.62	0.145	114.6	20.18	±	1.07	±	1.46
0.16–0.20	0.179	97.4	24.56	±	1.12	±	1.53	0.180	114.2	17.84	±	0.83	±	1.01
0.20–0.24	0.220	96.8	19.59	±	0.98	±	1.16	0.219	114.1	11.22	±	0.64	±	0.69
0.24–0.30	0.269	96.8	12.11	±	0.62	±	0.66	0.267	113.7	6.86	±	0.41	±	0.48
0.30–0.36	0.329	96.8	9.74	±	0.55	±	0.67	0.329	114.2	4.83	±	0.34	±	0.45
0.36–0.42	0.390	97.1	6.52	±	0.46	±	0.57	0.390	113.4	2.61	±	0.24	±	0.33
0.42–0.50	0.460	96.3	3.56	±	0.29	±	0.38	0.458	112.8	1.44	±	0.15	±	0.23
0.50–0.60	0.549	95.9	1.84	±	0.18	±	0.26	0.545	111.8	0.39	±	0.06	±	0.10
0.60–0.72	0.657	96.6	0.69	±	0.09	±	0.19	0.640	111.3	0.23	±	0.05	±	0.09
0.72–0.90	0.786	95.8	0.16	±	0.03	±	0.05							

Table A.6 Double-differential inclusive cross-section $d^2\sigma/dp\,d\Omega$ [mb/(GeV/c sr)] of the production of π^-'s in $\pi^+ + \mathrm{Be} \to \pi^- + \mathrm{X}$ interactions with +3.0 GeV/c beam momentum; the first error is statistical, the second systematic; p_T in GeV/c, polar angle θ in degrees

p_T	$20 < \theta < 30$							$30 < \theta < 40$						
	$\langle p_T \rangle$	$\langle \theta \rangle$	$d^2\sigma/dp\,d\Omega$					$\langle p_T \rangle$	$\langle \theta \rangle$	$d^2\sigma/dp\,d\Omega$				
0.10–0.13	0.116	24.7	30.88	±	1.92	±	3.72	0.116	34.5	22.19	±	1.56	±	2.72
0.13–0.16	0.145	24.6	37.24	±	1.96	±	3.16	0.146	35.0	31.28	±	1.75	±	3.34
0.16–0.20	0.180	24.9	40.74	±	1.69	±	2.75	0.181	34.8	29.45	±	1.39	±	2.40
0.20–0.24	0.220	24.9	44.76	±	1.77	±	2.68	0.220	34.8	32.04	±	1.46	±	2.08
0.24–0.30	0.269	25.0	37.20	±	1.30	±	1.80	0.269	34.8	31.91	±	1.17	±	1.72
0.30–0.36	0.328	24.9	33.42	±	1.24	±	1.54	0.329	34.8	27.38	±	1.09	±	1.41
0.36–0.42	0.389	25.1	26.86	±	1.12	±	1.35	0.388	34.8	21.11	±	0.96	±	1.16
0.42–0.50	0.456	25.0	18.55	±	0.80	±	1.06	0.457	34.6	15.18	±	0.71	±	0.89
0.50–0.60	0.543	25.0	9.36	±	0.50	±	0.68	0.543	34.8	9.29	±	0.50	±	0.70
0.60–0.72	0.651	25.0	5.11	±	0.35	±	0.52	0.652	34.5	4.87	±	0.34	±	0.52
0.72–0.90								0.784	35.0	1.98	±	0.19	±	0.26
p_T	$40 < \theta < 50$							$50 < \theta < 60$						
	$\langle p_T \rangle$	$\langle \theta \rangle$	$d^2\sigma/dp\,d\Omega$					$\langle p_T \rangle$	$\langle \theta \rangle$	$d^2\sigma/dp\,d\Omega$				
0.10–0.13	0.115	44.6	21.93	±	1.62	±	2.45							
0.13–0.16	0.144	44.7	26.26	±	1.62	±	2.46	0.146	54.6	23.61	±	1.58	±	2.20
0.16–0.20	0.180	44.6	26.11	±	1.34	±	1.95	0.180	54.7	21.65	±	1.22	±	1.59
0.20–0.24	0.219	44.8	25.18	±	1.30	±	1.69	0.219	54.6	22.61	±	1.26	±	1.74
0.24–0.30	0.267	44.8	25.29	±	1.05	±	1.36	0.269	54.9	18.22	±	0.90	±	1.12
0.30–0.36	0.327	44.3	22.08	±	1.00	±	1.25	0.328	54.8	15.85	±	0.84	±	0.92
0.36–0.42	0.387	44.6	16.81	±	0.85	±	1.06	0.388	54.5	11.86	±	0.73	±	0.76
0.42–0.50	0.456	44.9	12.20	±	0.65	±	0.81	0.455	54.9	9.31	±	0.57	±	0.64
0.50–0.60	0.540	44.8	6.91	±	0.43	±	0.56	0.541	55.0	5.19	±	0.38	±	0.46
0.60–0.72	0.653	44.5	3.73	±	0.29	±	0.41	0.647	54.6	2.77	±	0.25	±	0.31
0.72–0.90	0.788	44.7	1.56	±	0.16	±	0.23	0.789	54.8	1.06	±	0.13	±	0.17
0.90–1.25								0.992	54.7	0.13	±	0.02	±	0.04

Table A.6 (*Continued*)

p_T	$60 < \theta < 75$							$75 < \theta < 90$						
	$\langle p_T \rangle$	$\langle \theta \rangle$	$d^2\sigma/dp\,d\Omega$					$\langle p_T \rangle$	$\langle \theta \rangle$	$d^2\sigma/dp\,d\Omega$				
0.13–0.16	0.144	67.3	18.75	±	1.16	±	1.57	0.145	82.8	18.01	±	1.14	±	1.67
0.16–0.20	0.179	67.3	17.85	±	0.93	±	1.20	0.179	82.3	16.80	±	0.91	±	1.21
0.20–0.24	0.219	66.8	18.04	±	0.91	±	1.20	0.218	81.9	12.18	±	0.75	±	0.88
0.24–0.30	0.269	67.1	13.77	±	0.64	±	0.77	0.268	82.5	9.99	±	0.56	±	0.65
0.30–0.36	0.329	67.0	12.02	±	0.61	±	0.71	0.327	82.0	8.09	±	0.50	±	0.59
0.36–0.42	0.386	66.3	9.40	±	0.53	±	0.59	0.388	82.0	5.41	±	0.41	±	0.45
0.42–0.50	0.452	66.5	6.20	±	0.37	±	0.46	0.455	82.3	3.34	±	0.28	±	0.33
0.50–0.60	0.541	66.4	4.18	±	0.28	±	0.39	0.542	81.5	1.93	±	0.19	±	0.24
0.60–0.72	0.645	66.7	2.26	±	0.18	±	0.29	0.642	82.1	1.01	±	0.12	±	0.18
0.72–0.90	0.784	66.4	0.52	±	0.07	±	0.09	0.785	82.7	0.18	±	0.04	±	0.05
0.90–1.25	1.021	65.6	0.07	±	0.02	±	0.03							
p_T	$90 < \theta < 105$							$105 < \theta < 125$						
	$\langle p_T \rangle$	$\langle \theta \rangle$	$d^2\sigma/dp\,d\Omega$					$\langle p_T \rangle$	$\langle \theta \rangle$	$d^2\sigma/dp\,d\Omega$				
0.13–0.16	0.144	97.0	14.92	±	1.04	±	1.51	0.145	114.3	11.86	±	0.81	±	0.96
0.16–0.20	0.180	97.2	13.45	±	0.81	±	1.08	0.178	114.7	10.27	±	0.63	±	0.72
0.20–0.24	0.218	97.2	10.54	±	0.72	±	0.87	0.218	113.8	6.81	±	0.50	±	0.60
0.24–0.30	0.266	97.0	7.52	±	0.49	±	0.58	0.268	113.6	3.57	±	0.29	±	0.34
0.30–0.36	0.327	97.2	4.88	±	0.39	±	0.46	0.325	113.2	2.68	±	0.25	±	0.34
0.36–0.42	0.385	97.3	3.56	±	0.33	±	0.40	0.389	113.6	1.45	±	0.18	±	0.22
0.42–0.50	0.456	97.0	2.01	±	0.22	±	0.27	0.447	113.2	0.78	±	0.11	±	0.16
0.50–0.60	0.530	97.9	0.74	±	0.11	±	0.14	0.539	112.2	0.26	±	0.05	±	0.09
0.60–0.72	0.637	96.3	0.31	±	0.06	±	0.09	0.658	110.4	0.11	±	0.03	±	0.05
0.72–0.90	0.801	97.3	0.08	±	0.02	±	0.04							

Table A.7 Double-differential inclusive cross-section $d^2\sigma/dp\,d\Omega$ [mb/(GeV/c sr)] of the production of protons in $\pi^- + \mathrm{Be} \to \mathrm{p} + \mathrm{X}$ interactions with -3.0 GeV/c beam momentum; the first error is statistical, the second systematic; p_T in GeV/c, polar angle θ in degrees

p_T	$20 < \theta < 30$							$30 < \theta < 40$						
	$\langle p_\mathrm{T}\rangle$	$\langle\theta\rangle$	$d^2\sigma/dp\,d\Omega$					$\langle p_\mathrm{T}\rangle$	$\langle\theta\rangle$	$d^2\sigma/dp\,d\Omega$				
0.20–0.24	0.219	25.0	33.91	±	1.47	±	2.56							
0.24–0.30	0.267	25.0	33.11	±	1.17	±	2.03	0.268	34.8	31.08	±	1.12	±	1.87
0.30–0.36	0.327	25.1	31.93	±	1.16	±	1.79	0.326	34.8	26.38	±	1.01	±	1.47
0.36–0.42	0.386	25.1	28.54	±	1.07	±	1.56	0.385	34.9	23.94	±	0.99	±	1.30
0.42–0.50	0.452	25.0	24.84	±	0.87	±	1.28	0.452	35.0	21.35	±	0.82	±	1.05
0.50–0.60	0.538	25.1	20.22	±	0.71	±	0.99	0.541	34.9	18.89	±	0.70	±	0.98
0.60–0.72	0.642	25.1	13.32	±	0.51	±	0.73	0.643	34.7	12.44	±	0.51	±	0.73
0.72–0.90								0.781	35.1	8.20	±	0.35	±	0.62
p_T	$40 < \theta < 50$							$50 < \theta < 60$						
	$\langle p_\mathrm{T}\rangle$	$\langle\theta\rangle$	$d^2\sigma/dp\,d\Omega$					$\langle p_\mathrm{T}\rangle$	$\langle\theta\rangle$	$d^2\sigma/dp\,d\Omega$				
0.30–0.36	0.330	45.0	25.49	±	0.95	±	1.51							
0.36–0.42	0.389	45.1	22.78	±	0.92	±	1.17	0.389	55.1	23.63	±	0.93	±	1.29
0.42–0.50	0.458	45.0	19.31	±	0.77	±	1.01	0.459	55.0	18.58	±	0.72	±	1.02
0.50–0.60	0.547	45.1	15.77	±	0.64	±	0.86	0.549	55.1	14.23	±	0.61	±	0.84
0.60–0.72	0.656	45.0	11.75	±	0.53	±	0.81	0.657	54.8	10.03	±	0.49	±	0.72
0.72–0.90	0.801	44.9	6.18	±	0.31	±	0.50	0.798	54.9	5.16	±	0.29	±	0.45
0.90–1.25	1.034	44.7	1.94	±	0.12	±	0.25	1.028	54.8	0.84	±	0.08	±	0.15
p_T	$60 < \theta < 75$							$75 < \theta < 90$						
	$\langle p_\mathrm{T}\rangle$	$\langle\theta\rangle$	$d^2\sigma/dp\,d\Omega$					$\langle p_\mathrm{T}\rangle$	$\langle\theta\rangle$	$d^2\sigma/dp\,d\Omega$				
0.36–0.42	0.385	67.6	23.08	±	0.74	±	1.00							
0.42–0.50	0.452	67.5	19.40	±	0.60	±	0.82	0.452	81.8	15.01	±	0.52	±	0.80
0.50–0.60	0.538	67.4	13.83	±	0.47	±	0.69	0.535	81.9	7.82	±	0.34	±	0.53
0.60–0.72	0.642	67.1	7.44	±	0.33	±	0.56	0.641	81.8	3.85	±	0.24	±	0.42
0.72–0.90	0.777	66.5	2.74	±	0.17	±	0.33	0.769	81.7	1.36	±	0.13	±	0.23
0.90–1.25	0.988	66.9	0.44	±	0.05	±	0.13	0.999	81.0	0.17	±	0.03	±	0.07
p_T	$90 < \theta < 105$							$105 < \theta < 125$						
	$\langle p_\mathrm{T}\rangle$	$\langle\theta\rangle$	$d^2\sigma/dp\,d\Omega$					$\langle p_\mathrm{T}\rangle$	$\langle\theta\rangle$	$d^2\sigma/dp\,d\Omega$				
0.36–0.42								0.383	114.3	5.20	±	0.29	±	0.42
0.42–0.50	0.452	96.7	7.99	±	0.37	±	0.66	0.449	113.5	3.79	±	0.23	±	0.31
0.50–0.60	0.538	96.7	4.57	±	0.26	±	0.49	0.536	113.5	1.67	±	0.15	±	0.23
0.60–0.72	0.640	97.0	1.57	±	0.16	±	0.26	0.638	112.8	0.40	±	0.07	±	0.12
0.72–0.90	0.776	96.8	0.37	±	0.07	±	0.11	0.770	112.5	0.09	±	0.03	±	0.08

Table A.8 Double-differential inclusive cross-section $d^2\sigma/dp\,d\Omega$ [mb/(GeV/c sr)] of the production of π^+'s in $\pi^- + \mathrm{Be} \to \pi^+ + \mathrm{X}$ interactions with -3.0 GeV/c beam momentum; the first error is statistical, the second systematic; p_T in GeV/c, polar angle θ in degrees

p_T	$20 < \theta < 30$							$30 < \theta < 40$						
	$\langle p_\mathrm{T}\rangle$	$\langle\theta\rangle$	$d^2\sigma/dp\,d\Omega$					$\langle p_\mathrm{T}\rangle$	$\langle\theta\rangle$	$d^2\sigma/dp\,d\Omega$				
0.10–0.13	0.116	25.0	29.21	±	1.74	±	3.26	0.115	34.9	23.15	±	1.54	±	2.62
0.13–0.16	0.144	24.9	35.55	±	1.85	±	3.30	0.144	34.9	28.39	±	1.54	±	2.67
0.16–0.20	0.180	24.8	40.36	±	1.62	±	2.65	0.180	34.8	33.48	±	1.44	±	2.45
0.20–0.24	0.219	24.9	41.34	±	1.60	±	2.37	0.219	34.7	33.44	±	1.43	±	2.27
0.24–0.30	0.267	24.9	39.24	±	1.28	±	1.87	0.268	34.7	35.03	±	1.20	±	2.00
0.30–0.36	0.326	25.1	33.02	±	1.16	±	1.51	0.326	34.8	26.02	±	1.01	±	1.34
0.36–0.42	0.385	24.8	30.08	±	1.14	±	1.52	0.384	34.6	22.82	±	0.95	±	1.24
0.42–0.50	0.450	25.0	19.96	±	0.77	±	1.08	0.451	34.7	17.07	±	0.73	±	0.97
0.50–0.60	0.537	24.9	9.92	±	0.44	±	0.71	0.538	34.8	10.06	±	0.48	±	0.70
0.60–0.72	0.643	25.1	4.64	±	0.26	±	0.46	0.642	34.9	4.85	±	0.29	±	0.46
0.72–0.90								0.770	34.9	2.09	±	0.14	±	0.29
p_T	$40 < \theta < 50$							$50 < \theta < 60$						
	$\langle p_\mathrm{T}\rangle$	$\langle\theta\rangle$	$d^2\sigma/dp\,d\Omega$					$\langle p_\mathrm{T}\rangle$	$\langle\theta\rangle$	$d^2\sigma/dp\,d\Omega$				
0.10–0.13	0.117	44.9	21.69	±	1.51	±	2.58							
0.13–0.16	0.145	44.8	25.29	±	1.56	±	2.28	0.146	55.0	20.66	±	1.37	±	1.94
0.16–0.20	0.180	45.0	25.92	±	1.27	±	1.97	0.180	54.9	25.83	±	1.32	±	1.83
0.20–0.24	0.219	44.4	29.52	±	1.38	±	2.04	0.219	54.5	20.63	±	1.10	±	1.49
0.24–0.30	0.269	44.7	24.30	±	0.97	±	1.35	0.270	54.6	18.92	±	0.89	±	1.13
0.30–0.36	0.330	44.8	19.35	±	0.88	±	1.01	0.330	54.7	16.04	±	0.81	±	0.91
0.36–0.42	0.389	45.0	15.92	±	0.80	±	0.92	0.388	54.8	13.50	±	0.75	±	0.81
0.42–0.50	0.457	44.7	12.48	±	0.63	±	0.77	0.455	54.7	9.33	±	0.54	±	0.58
0.50–0.60	0.547	44.8	7.93	±	0.44	±	0.58	0.544	54.7	5.37	±	0.34	±	0.42
0.60–0.72	0.654	44.7	4.22	±	0.28	±	0.43	0.650	54.4	3.37	±	0.26	±	0.37
0.72–0.90	0.793	45.2	1.63	±	0.13	±	0.22	0.790	54.1	1.14	±	0.11	±	0.18
0.90–1.25								1.014	54.2	0.16	±	0.02	±	0.05
p_T	$60 < \theta < 75$							$75 < \theta < 90$						
	$\langle p_\mathrm{T}\rangle$	$\langle\theta\rangle$	$d^2\sigma/dp\,d\Omega$					$\langle p_\mathrm{T}\rangle$	$\langle\theta\rangle$	$d^2\sigma/dp\,d\Omega$				
0.13–0.16	0.146	67.2	15.97	±	1.01	±	1.35	0.146	82.6	15.06	±	0.99	±	1.39
0.16–0.20	0.178	67.4	17.11	±	0.86	±	1.14	0.179	82.5	14.95	±	0.80	±	1.06
0.20–0.24	0.218	67.2	15.09	±	0.79	±	0.95	0.218	82.2	11.90	±	0.72	±	0.81
0.24–0.30	0.266	66.9	13.94	±	0.62	±	0.78	0.266	81.8	10.16	±	0.52	±	0.65
0.30–0.36	0.325	67.2	10.63	±	0.55	±	0.62	0.325	81.8	7.59	±	0.46	±	0.51
0.36–0.42	0.383	66.4	7.96	±	0.47	±	0.50	0.384	82.3	5.41	±	0.39	±	0.43
0.42–0.50	0.451	67.3	5.92	±	0.35	±	0.41	0.449	82.0	3.92	±	0.29	±	0.38
0.50–0.60	0.539	67.2	3.52	±	0.23	±	0.31	0.536	82.2	1.94	±	0.17	±	0.25
0.60–0.72	0.638	66.6	1.70	±	0.14	±	0.20	0.644	81.8	0.84	±	0.09	±	0.16
0.72–0.90	0.766	66.2	0.54	±	0.06	±	0.11	0.767	81.5	0.25	±	0.04	±	0.06
0.90–1.25	0.980	65.8	0.07	±	0.02	±	0.02							

Table A.8 (*Continued*)

p_T	$90 < \theta < 105$							$105 < \theta < 125$						
	$\langle p_T \rangle$	$\langle \theta \rangle$	$d^2\sigma/dp\,d\Omega$					$\langle p_T \rangle$	$\langle \theta \rangle$	$d^2\sigma/dp\,d\Omega$				
0.13–0.16	0.145	97.2	11.20	±	0.84	±	1.11	0.144	113.9	10.34	±	0.72	±	0.85
0.16–0.20	0.179	97.4	12.05	±	0.72	±	0.92	0.178	114.4	8.56	±	0.55	±	0.61
0.20–0.24	0.217	97.4	9.60	±	0.66	±	0.74	0.216	114.1	6.08	±	0.45	±	0.49
0.24–0.30	0.266	97.7	6.84	±	0.45	±	0.50	0.265	113.4	4.15	±	0.30	±	0.34
0.30–0.36	0.325	96.8	4.72	±	0.36	±	0.42	0.322	113.8	2.53	±	0.23	±	0.27
0.36–0.42	0.387	97.0	2.92	±	0.28	±	0.31	0.387	114.2	1.53	±	0.17	±	0.22
0.42–0.50	0.447	96.9	2.06	±	0.20	±	0.27	0.451	113.3	0.96	±	0.12	±	0.19
0.50–0.60	0.531	95.9	0.90	±	0.11	±	0.17	0.525	113.1	0.31	±	0.05	±	0.08
0.60–0.72	0.632	96.9	0.28	±	0.05	±	0.10	0.643	113.0	0.13	±	0.03	±	0.08
0.72–0.90	0.757	99.2	0.03	±	0.02	±	0.01							

Table A.9 Double-differential inclusive cross-section $d^2\sigma/dp\,d\Omega$ [mb/(GeV/c sr)] of the production of π^-'s in $\pi^- + \mathrm{Be} \to \pi^- + \mathrm{X}$ interactions with -3.0 GeV/c beam momentum; the first error is statistical, the second systematic; p_T in GeV/c, polar angle θ in degrees

p_T	$20 < \theta < 30$							$30 < \theta < 40$						
	$\langle p_T \rangle$	$\langle \theta \rangle$	$d^2\sigma/dp\,d\Omega$					$\langle p_T \rangle$	$\langle \theta \rangle$	$d^2\sigma/dp\,d\Omega$				
0.10–0.13	0.117	24.8	52.04	±	2.38	±	4.76	0.116	34.9	41.17	±	2.09	±	3.81
0.13–0.16	0.146	24.8	63.35	±	2.45	±	4.58	0.146	35.0	49.12	±	2.09	±	3.69
0.16–0.20	0.181	24.7	71.79	±	2.15	±	4.11	0.181	34.8	55.30	±	1.86	±	3.42
0.20–0.24	0.221	24.8	69.90	±	2.12	±	3.49	0.221	34.8	62.10	±	1.95	±	3.29
0.24–0.30	0.271	24.7	68.25	±	1.67	±	2.72	0.272	34.9	57.09	±	1.50	±	2.48
0.30–0.36	0.333	25.0	59.39	±	1.55	±	2.20	0.332	34.8	50.60	±	1.41	±	2.03
0.36–0.42	0.393	25.1	48.64	±	1.42	±	2.03	0.394	34.9	41.06	±	1.28	±	1.75
0.42–0.50	0.464	24.9	37.94	±	1.09	±	1.71	0.464	35.1	32.43	±	1.00	±	1.51
0.50–0.60	0.555	25.1	24.23	±	0.77	±	1.42	0.554	34.9	20.71	±	0.69	±	1.21
0.60–0.72	0.669	25.1	14.21	±	0.56	±	1.12	0.669	34.8	13.86	±	0.55	±	1.09
0.72–0.90								0.817	34.8	6.91	±	0.33	±	0.75
p_T	$40 < \theta < 50$							$50 < \theta < 60$						
	$\langle p_T \rangle$	$\langle \theta \rangle$	$d^2\sigma/dp\,d\Omega$					$\langle p_T \rangle$	$\langle \theta \rangle$	$d^2\sigma/dp\,d\Omega$				
0.10–0.13	0.116	44.9	40.23	±	2.14	±	3.81							
0.13–0.16	0.145	44.8	43.31	±	1.97	±	3.18	0.145	54.9	40.62	±	1.97	±	3.09
0.16–0.20	0.179	44.9	48.36	±	1.74	±	3.00	0.180	55.1	42.09	±	1.68	±	2.62
0.20–0.24	0.221	44.8	50.20	±	1.75	±	2.76	0.220	54.9	40.28	±	1.59	±	2.17
0.24–0.30	0.270	44.7	46.13	±	1.37	±	2.07	0.269	54.8	33.81	±	1.16	±	1.56
0.30–0.36	0.329	44.7	39.36	±	1.23	±	1.70	0.329	54.7	29.67	±	1.08	±	1.31
0.36–0.42	0.390	44.7	34.59	±	1.17	±	1.57	0.390	54.7	22.99	±	0.96	±	1.10
0.42–0.50	0.457	44.7	25.86	±	0.89	±	1.30	0.457	54.7	18.61	±	0.75	±	0.98
0.50–0.60	0.547	44.7	18.97	±	0.68	±	1.19	0.546	54.8	13.52	±	0.57	±	0.89
0.60–0.72	0.653	44.9	11.24	±	0.48	±	0.95	0.654	54.6	9.31	±	0.44	±	0.82
0.72–0.90	0.795	45.3	5.77	±	0.30	±	0.69	0.792	54.7	3.89	±	0.24	±	0.47
0.90–1.25								1.015	54.8	0.55	±	0.05	±	0.11

Table A.9 (*Continued*)

p_T	$60 < \theta < 75$							$75 < \theta < 90$						
	$\langle p_T \rangle$	$\langle \theta \rangle$	$d^2\sigma/dp\,d\Omega$					$\langle p_T \rangle$	$\langle \theta \rangle$	$d^2\sigma/dp\,d\Omega$				
0.13–0.16	0.146	67.2	33.59	±	1.47	±	2.45	0.147	82.6	26.96	±	1.30	±	2.10
0.16–0.20	0.181	67.1	36.93	±	1.28	±	2.13	0.181	82.3	30.47	±	1.17	±	1.80
0.20–0.24	0.221	67.1	31.13	±	1.13	±	1.64	0.220	82.0	26.87	±	1.07	±	1.47
0.24–0.30	0.271	67.0	25.95	±	0.84	±	1.13	0.271	82.3	19.09	±	0.73	±	0.99
0.30–0.36	0.333	67.2	22.56	±	0.78	±	1.00	0.330	81.9	13.08	±	0.60	±	0.72
0.36–0.42	0.393	66.8	17.17	±	0.69	±	0.86	0.393	81.9	10.09	±	0.52	±	0.67
0.42–0.50	0.465	66.5	13.19	±	0.51	±	0.76	0.462	81.7	8.45	±	0.41	±	0.65
0.50–0.60	0.557	66.9	8.15	±	0.36	±	0.61	0.553	81.9	4.59	±	0.28	±	0.45
0.60–0.72	0.667	66.9	4.73	±	0.26	±	0.47	0.664	81.5	2.18	±	0.17	±	0.28
0.72–0.90	0.805	66.8	1.97	±	0.13	±	0.26	0.811	81.0	0.63	±	0.06	±	0.12
0.90–1.25	1.047	66.1	0.17	±	0.02	±	0.04	1.049	80.5	0.05	±	0.01	±	0.02
p_T	$90 < \theta < 105$							$105 < \theta < 125$						
	$\langle p_T \rangle$	$\langle \theta \rangle$	$d^2\sigma/dp\,d\Omega$					$\langle p_T \rangle$	$\langle \theta \rangle$	$d^2\sigma/dp\,d\Omega$				
0.13–0.16	0.146	97.1	27.64	±	1.33	±	2.12	0.146	114.8	25.29	±	1.11	±	1.59
0.16–0.20	0.181	97.6	24.44	±	1.03	±	1.44	0.180	113.9	20.30	±	0.83	±	1.03
0.20–0.24	0.221	97.0	19.49	±	0.91	±	1.11	0.219	114.2	13.21	±	0.67	±	0.73
0.24–0.30	0.270	97.1	15.05	±	0.66	±	0.87	0.270	114.1	8.17	±	0.41	±	0.54
0.30–0.36	0.331	97.0	9.62	±	0.51	±	0.68	0.329	113.3	5.01	±	0.32	±	0.46
0.36–0.42	0.391	97.5	6.99	±	0.43	±	0.63	0.393	112.4	2.66	±	0.24	±	0.32
0.42–0.50	0.466	96.4	3.84	±	0.28	±	0.42	0.459	111.8	1.28	±	0.14	±	0.21
0.50–0.60	0.549	95.9	1.71	±	0.16	±	0.26	0.551	110.0	0.40	±	0.06	±	0.10
0.60–0.72	0.672	95.8	0.60	±	0.08	±	0.13	0.665	109.4	0.10	±	0.03	±	0.04
0.72–0.90	0.799	95.5	0.09	±	0.02	±	0.04							

Table A.10 Double-differential inclusive cross-section $d^2\sigma/dp\,d\Omega$ [mb/(GeV/c sr)] of the production of protons in p + Be → p + X interactions with +5.0 GeV/c beam momentum; the first error is statistical, the second systematic; p_T in GeV/c, polar angle θ in degrees

p_T	$20 < \theta < 30$							$30 < \theta < 40$						
	$\langle p_T \rangle$	$\langle \theta \rangle$	$d^2\sigma/dp\,d\Omega$					$\langle p_T \rangle$	$\langle \theta \rangle$	$d^2\sigma/dp\,d\Omega$				
0.20–0.24	0.221	24.9	45.44	±	1.74	±	3.07							
0.24–0.30	0.271	24.8	43.38	±	1.46	±	2.86	0.271	34.7	42.88	±	1.33	±	2.32
0.30–0.36	0.330	24.9	40.05	±	1.45	±	2.96	0.330	34.7	39.38	±	1.34	±	2.20
0.36–0.42	0.390	24.9	36.14	±	1.33	±	2.44	0.389	34.9	31.72	±	1.28	±	2.49
0.42–0.50	0.459	24.9	35.43	±	1.13	±	2.21	0.459	34.9	30.16	±	1.13	±	2.28
0.50–0.60	0.547	24.8	31.41	±	0.97	±	1.94	0.549	35.1	22.92	±	0.85	±	1.82
0.60–0.72	0.657	24.9	23.45	±	0.73	±	1.54	0.654	34.9	18.06	±	0.72	±	1.68
0.72–0.90								0.801	34.7	9.06	±	0.40	±	1.11
p_T	$40 < \theta < 50$							$50 < \theta < 60$						
	$\langle p_T \rangle$	$\langle \theta \rangle$	$d^2\sigma/dp\,d\Omega$					$\langle p_T \rangle$	$\langle \theta \rangle$	$d^2\sigma/dp\,d\Omega$				
0.30–0.36	0.329	45.0	38.76	±	1.27	±	1.79							
0.36–0.42	0.389	45.0	32.78	±	1.18	±	1.60	0.390	55.0	35.42	±	1.19	±	1.50
0.42–0.50	0.459	45.0	24.72	±	0.98	±	1.84	0.459	55.1	30.70	±	1.02	±	1.41
0.50–0.60	0.549	45.1	21.46	±	0.85	±	1.73	0.548	55.0	21.29	±	0.86	±	1.87
0.60–0.72	0.657	44.9	14.46	±	0.66	±	1.53	0.656	54.8	9.95	±	0.54	±	1.29
0.72–0.90	0.799	45.0	7.29	±	0.41	±	1.16	0.799	54.8	4.24	±	0.32	±	0.91
0.90–1.25	1.025	44.5	1.49	±	0.12	±	0.55	1.024	54.5	0.97	±	0.09	±	0.58
p_T	$60 < \theta < 75$							$75 < \theta < 90$						
	$\langle p_T \rangle$	$\langle \theta \rangle$	$d^2\sigma/dp\,d\Omega$					$\langle p_T \rangle$	$\langle \theta \rangle$	$d^2\sigma/dp\,d\Omega$				
0.36–0.42	0.391	67.6	33.05	±	0.92	±	1.28							
0.42–0.50	0.461	67.3	29.97	±	0.78	±	1.11	0.460	81.8	20.96	±	0.64	±	0.99
0.50–0.60	0.549	66.9	19.40	±	0.62	±	1.29	0.549	81.5	10.97	±	0.44	±	0.77
0.60–0.72	0.658	67.2	6.76	±	0.37	±	1.12	0.657	81.3	2.90	±	0.26	±	0.79
0.72–0.90	0.798	66.7	2.75	±	0.20	±	0.90	0.800	81.8	1.42	±	0.15	±	0.73
0.90–1.25	1.036	66.6	0.75	±	0.08	±	0.58							
p_T	$90 < \theta < 105$							$105 < \theta < 125$						
	$\langle p_T \rangle$	$\langle \theta \rangle$	$d^2\sigma/dp\,d\Omega$					$\langle p_T \rangle$	$\langle \theta \rangle$	$d^2\sigma/dp\,d\Omega$				
0.36–0.42								0.391	113.6	7.45	±	0.38	±	0.47
0.42–0.50	0.459	96.7	10.91	±	0.45	±	0.79	0.458	113.1	3.59	±	0.25	±	0.31
0.50–0.60	0.549	96.7	4.83	±	0.32	±	0.52	0.544	112.8	0.86	±	0.13	±	0.40
0.60–0.72	0.661	96.3	1.07	±	0.14	±	0.66							

Table A.11 Double-differential inclusive cross-section $d^2\sigma/dp\,d\Omega$ [mb/(GeV/c sr)] of the production of π^+'s in p + Be $\to \pi^+ +$ X interactions with +5.0 GeV/c beam momentum; the first error is statistical, the second systematic; p_T in GeV/c, polar angle θ in degrees

p_T	$20 < \theta < 30$							$30 < \theta < 40$						
	$\langle p_T \rangle$	$\langle \theta \rangle$	$d^2\sigma/dp\,d\Omega$					$\langle p_T \rangle$	$\langle \theta \rangle$	$d^2\sigma/dp\,d\Omega$				
0.10–0.13	0.115	25.1	51.01	±	2.51	±	4.66	0.115	34.8	36.25	±	2.02	±	3.39
0.13–0.16	0.146	25.0	58.36	±	2.44	±	4.22	0.146	34.7	40.18	±	1.97	±	3.02
0.16–0.20	0.180	24.7	67.65	±	2.16	±	3.93	0.180	34.6	49.15	±	1.87	±	3.07
0.20–0.24	0.220	24.6	70.51	±	2.21	±	3.90	0.220	34.5	44.32	±	1.66	±	2.50
0.24–0.30	0.269	24.7	59.93	±	1.63	±	2.68	0.269	34.6	42.81	±	1.36	±	2.00
0.30–0.36	0.328	24.9	44.50	±	1.38	±	1.93	0.328	34.6	32.99	±	1.18	±	1.51
0.36–0.42	0.389	24.8	33.20	±	1.18	±	1.56	0.389	34.6	28.65	±	1.12	±	1.47
0.42–0.50	0.459	24.8	22.23	±	0.81	±	1.14	0.456	34.8	21.63	±	0.82	±	1.13
0.50–0.60	0.546	24.6	15.78	±	0.60	±	1.02	0.545	34.6	12.17	±	0.53	±	0.77
0.60–0.72	0.657	24.9	8.99	±	0.37	±	0.81	0.655	34.6	6.93	±	0.34	±	0.61
0.72–0.90								0.799	34.7	3.92	±	0.21	±	0.51
p_T	$40 < \theta < 50$							$50 < \theta < 60$						
	$\langle p_T \rangle$	$\langle \theta \rangle$	$d^2\sigma/dp\,d\Omega$					$\langle p_T \rangle$	$\langle \theta \rangle$	$d^2\sigma/dp\,d\Omega$				
0.10–0.13	0.116	44.8	23.50	±	1.57	±	2.46							
0.13–0.16	0.146	44.9	33.42	±	1.81	±	2.64	0.145	54.9	25.86	±	1.63	±	2.26
0.16–0.20	0.180	44.8	38.70	±	1.66	±	2.60	0.181	54.7	27.80	±	1.39	±	1.90
0.20–0.24	0.219	44.7	35.19	±	1.56	±	2.17	0.219	55.0	27.15	±	1.39	±	1.78
0.24–0.30	0.270	44.8	29.92	±	1.14	±	1.50	0.269	54.8	24.24	±	1.02	±	1.33
0.30–0.36	0.329	44.7	25.71	±	1.06	±	1.30	0.329	54.8	16.87	±	0.83	±	0.96
0.36–0.42	0.389	44.8	19.30	±	0.92	±	1.07	0.388	54.8	13.97	±	0.78	±	0.84
0.42–0.50	0.458	44.7	13.41	±	0.62	±	0.79	0.458	54.7	11.10	±	0.60	±	0.71
0.50–0.60	0.547	44.5	8.76	±	0.48	±	0.64	0.545	54.7	7.02	±	0.42	±	0.54
0.60–0.72	0.653	44.5	4.99	±	0.31	±	0.46	0.659	54.5	3.19	±	0.25	±	0.32
0.72–0.90	0.793	44.4	2.10	±	0.15	±	0.28	0.795	54.2	1.58	±	0.14	±	0.23
0.90–1.25								1.027	54.5	0.22	±	0.03	±	0.06
p_T	$60 < \theta < 75$							$75 < \theta < 90$						
	$\langle p_T \rangle$	$\langle \theta \rangle$	$d^2\sigma/dp\,d\Omega$					$\langle p_T \rangle$	$\langle \theta \rangle$	$d^2\sigma/dp\,d\Omega$				
0.13–0.16	0.145	67.3	18.92	±	1.13	±	1.60	0.145	82.7	15.63	±	1.00	±	1.44
0.16–0.20	0.180	67.1	22.04	±	1.01	±	1.45	0.181	82.5	16.42	±	0.85	±	1.13
0.20–0.24	0.220	66.7	22.90	±	1.01	±	1.36	0.220	82.2	16.89	±	0.89	±	1.08
0.24–0.30	0.269	66.8	16.22	±	0.70	±	0.88	0.268	81.8	12.19	±	0.60	±	0.72
0.30–0.36	0.329	66.9	12.06	±	0.60	±	0.72	0.330	82.1	8.26	±	0.49	±	0.60
0.36–0.42	0.391	66.6	8.23	±	0.46	±	0.54	0.389	81.7	6.39	±	0.45	±	0.59
0.42–0.50	0.461	66.5	6.45	±	0.36	±	0.45	0.457	82.5	2.81	±	0.24	±	0.27
0.50–0.60	0.547	66.5	4.04	±	0.27	±	0.35	0.547	81.9	2.09	±	0.20	±	0.25
0.60–0.72	0.657	67.1	2.29	±	0.18	±	0.27	0.661	81.6	1.04	±	0.13	±	0.17
0.72–0.90	0.800	66.5	0.72	±	0.08	±	0.12	0.800	81.2	0.17	±	0.03	±	0.06
0.90–1.25	1.019	65.3	0.09	±	0.02	±	0.03							

Table A.11 (*Continued*)

p_T	$90 < \theta < 105$							$105 < \theta < 125$						
	$\langle p_T \rangle$	$\langle \theta \rangle$	$d^2\sigma/dp\,d\Omega$					$\langle p_T \rangle$	$\langle \theta \rangle$	$d^2\sigma/dp\,d\Omega$				
0.13–0.16	0.146	97.5	14.62	±	0.95	±	1.43	0.145	114.7	14.61	±	0.82	±	1.21
0.16–0.20	0.181	97.0	16.88	±	0.91	±	1.19	0.178	114.6	11.77	±	0.65	±	0.76
0.20–0.24	0.218	97.3	13.26	±	0.77	±	0.94	0.220	113.9	7.47	±	0.50	±	0.59
0.24–0.30	0.269	97.3	8.23	±	0.50	±	0.58	0.268	113.3	4.04	±	0.31	±	0.37
0.30–0.36	0.327	97.1	4.11	±	0.33	±	0.39	0.331	112.9	1.85	±	0.19	±	0.24
0.36–0.42	0.387	96.9	2.70	±	0.27	±	0.31	0.391	113.7	1.22	±	0.17	±	0.21
0.42–0.50	0.454	96.8	1.63	±	0.17	±	0.23	0.458	112.6	0.37	±	0.07	±	0.08
0.50–0.60	0.539	97.1	0.72	±	0.12	±	0.13	0.539	113.2	0.12	±	0.03	±	0.05
0.60–0.72	0.659	96.6	0.17	±	0.04	±	0.06							

Table A.12 Double-differential inclusive cross-section $d^2\sigma/dp\,d\Omega$ [mb/(GeV/c sr)] of the production of π^-'s in $p + Be \to \pi^- + X$ interactions with +5.0 GeV/c beam momentum; the first error is statistical, the second systematic; p_T in GeV/c, polar angle θ in degrees

p_T	$20 < \theta < 30$							$30 < \theta < 40$						
	$\langle p_T \rangle$	$\langle \theta \rangle$	$d^2\sigma/dp\,d\Omega$					$\langle p_T \rangle$	$\langle \theta \rangle$	$d^2\sigma/dp\,d\Omega$				
0.10–0.13	0.116	24.7	36.19	±	2.03	±	3.60	0.115	34.9	29.24	±	1.80	±	2.99
0.13–0.16	0.145	24.8	48.74	±	2.25	±	4.00	0.145	34.9	32.40	±	1.69	±	2.71
0.16–0.20	0.180	24.9	44.98	±	1.71	±	2.89	0.180	34.7	37.10	±	1.63	±	2.56
0.20–0.24	0.219	24.8	41.84	±	1.69	±	2.42	0.220	34.9	35.98	±	1.54	±	2.21
0.24–0.30	0.269	25.0	36.76	±	1.27	±	1.78	0.268	34.9	28.04	±	1.08	±	1.45
0.30–0.36	0.329	25.1	27.54	±	1.11	±	1.38	0.329	34.7	23.88	±	1.01	±	1.24
0.36–0.42	0.388	24.9	19.44	±	0.91	±	1.10	0.388	34.8	15.08	±	0.75	±	0.91
0.42–0.50	0.458	25.1	11.60	±	0.62	±	0.74	0.457	34.9	14.42	±	0.72	±	0.99
0.50–0.60	0.542	25.0	6.97	±	0.43	±	0.56	0.549	35.0	7.28	±	0.43	±	0.58
0.60–0.72	0.656	25.4	3.14	±	0.25	±	0.35	0.657	34.9	3.57	±	0.28	±	0.38
0.72–0.90								0.782	34.6	1.13	±	0.12	±	0.16
p_T	$40 < \theta < 50$							$50 < \theta < 60$						
	$\langle p_T \rangle$	$\langle \theta \rangle$	$d^2\sigma/dp\,d\Omega$					$\langle p_T \rangle$	$\langle \theta \rangle$	$d^2\sigma/dp\,d\Omega$				
0.10–0.13	0.115	44.8	23.15	±	1.60	±	2.53							
0.13–0.16	0.146	44.9	31.22	±	1.78	±	2.67	0.146	54.8	21.23	±	1.40	±	1.93
0.16–0.20	0.180	45.1	28.87	±	1.43	±	2.02	0.179	54.9	23.44	±	1.26	±	1.68
0.20–0.24	0.219	44.9	27.86	±	1.36	±	1.88	0.220	54.7	23.77	±	1.30	±	1.67
0.24–0.30	0.269	44.8	25.22	±	1.07	±	1.40	0.270	54.9	17.08	±	0.85	±	1.08
0.30–0.36	0.330	44.9	16.84	±	0.83	±	0.94	0.330	54.7	12.20	±	0.71	±	0.79
0.36–0.42	0.388	44.7	16.05	±	0.86	±	1.05	0.388	54.8	12.25	±	0.72	±	0.88
0.42–0.50	0.459	44.8	8.95	±	0.50	±	0.63	0.456	54.7	7.76	±	0.50	±	0.57
0.50–0.60	0.544	44.9	6.37	±	0.42	±	0.54	0.546	54.7	4.02	±	0.31	±	0.36
0.60–0.72	0.653	44.6	2.79	±	0.23	±	0.31	0.649	54.8	2.20	±	0.22	±	0.27
0.72–0.90	0.790	44.1	1.05	±	0.12	±	0.16	0.797	54.9	0.63	±	0.08	±	0.13
0.90–1.25								1.015	54.9	0.15	±	0.03	±	0.05

Table A.12 (*Continued*)

p_T	$60 < \theta < 75$							$75 < \theta < 90$						
	$\langle p_T \rangle$	$\langle \theta \rangle$	$d^2\sigma/dp\,d\Omega$					$\langle p_T \rangle$	$\langle \theta \rangle$	$d^2\sigma/dp\,d\Omega$				
0.13–0.16	0.145	67.4	18.89	±	1.11	±	1.65	0.146	82.6	16.53	±	1.03	±	1.51
0.16–0.20	0.180	67.4	20.36	±	0.97	±	1.35	0.180	82.2	16.12	±	0.84	±	1.12
0.20–0.24	0.220	67.0	17.89	±	0.91	±	1.07	0.220	81.8	15.50	±	0.84	±	1.01
0.24–0.30	0.267	66.7	13.63	±	0.64	±	0.77	0.267	82.1	10.46	±	0.55	±	0.67
0.30–0.36	0.329	66.8	9.42	±	0.51	±	0.61	0.328	82.4	5.98	±	0.41	±	0.47
0.36–0.42	0.386	66.7	7.66	±	0.48	±	0.55	0.386	82.0	4.54	±	0.37	±	0.43
0.42–0.50	0.454	67.1	5.19	±	0.33	±	0.41	0.453	81.5	3.26	±	0.26	±	0.35
0.50–0.60	0.540	66.6	2.69	±	0.22	±	0.25	0.542	81.2	1.53	±	0.16	±	0.21
0.60–0.72	0.646	66.1	1.24	±	0.13	±	0.16	0.657	80.6	0.44	±	0.07	±	0.10
0.72–0.90	0.782	66.8	0.28	±	0.05	±	0.06	0.786	82.9	0.04	±	0.02	±	0.02
0.90–1.25	1.076	66.4	0.04	±	0.01	±	0.02							
p_T	$90 < \theta < 105$							$105 < \theta < 125$						
	$\langle p_T \rangle$	$\langle \theta \rangle$	$d^2\sigma/dp\,d\Omega$					$\langle p_T \rangle$	$\langle \theta \rangle$	$d^2\sigma/dp\,d\Omega$				
0.13–0.16	0.145	97.5	15.36	±	0.99	±	1.44	0.144	114.8	15.54	±	0.88	±	1.21
0.16–0.20	0.179	97.6	14.54	±	0.80	±	1.03	0.179	114.0	12.75	±	0.69	±	0.86
0.20–0.24	0.219	97.2	12.63	±	0.77	±	0.89	0.218	114.1	6.18	±	0.46	±	0.49
0.24–0.30	0.268	96.7	7.83	±	0.48	±	0.58	0.266	113.6	3.39	±	0.28	±	0.33
0.30–0.36	0.326	96.7	4.32	±	0.36	±	0.46	0.323	112.7	2.20	±	0.22	±	0.30
0.36–0.42	0.386	96.8	2.26	±	0.25	±	0.29	0.385	113.2	1.22	±	0.16	±	0.22
0.42–0.50	0.448	96.1	1.37	±	0.17	±	0.20	0.444	111.8	0.53	±	0.10	±	0.12
0.50–0.60	0.538	96.8	0.49	±	0.10	±	0.10	0.538	111.8	0.13	±	0.04	±	0.05
0.60–0.72	0.635	96.9	0.13	±	0.04	±	0.05							

Table A.13 Double-differential inclusive cross-section $d^2\sigma/dp\,d\Omega$ [mb/(GeV/c sr)] of the production of protons in $\pi^+ + \mathrm{Be} \to \mathrm{p} + \mathrm{X}$ interactions with +5.0 GeV/c beam momentum; the first error is statistical, the second systematic; p_T in GeV/c, polar angle θ in degrees

p_T	$20 < \theta < 30$							$30 < \theta < 40$						
	$\langle p_\mathrm{T}\rangle$	$\langle\theta\rangle$	$d^2\sigma/dp\,d\Omega$					$\langle p_\mathrm{T}\rangle$	$\langle\theta\rangle$	$d^2\sigma/dp\,d\Omega$				
0.20–0.24	0.221	24.9	41.92	±	1.44	±	3.27							
0.24–0.30	0.269	25.1	39.00	±	1.13	±	2.33	0.271	34.8	36.94	±	1.07	±	2.36
0.30–0.36	0.330	25.1	37.51	±	1.10	±	2.14	0.330	34.9	33.98	±	1.03	±	1.76
0.36–0.42	0.389	25.3	33.64	±	1.04	±	1.74	0.389	34.9	33.01	±	1.02	±	1.68
0.42–0.50	0.459	25.0	32.55	±	0.87	±	1.53	0.458	35.0	28.64	±	0.83	±	1.30
0.50–0.60	0.548	24.7	25.81	±	0.67	±	1.19	0.548	34.9	23.33	±	0.66	±	1.06
0.60–0.72	0.656	25.2	20.73	±	0.54	±	1.07	0.656	34.8	18.88	±	0.54	±	0.99
0.72–0.90								0.802	34.9	12.09	±	0.36	±	0.80
p_T	$40 < \theta < 50$							$50 < \theta < 60$						
	$\langle p_\mathrm{T}\rangle$	$\langle\theta\rangle$	$d^2\sigma/dp\,d\Omega$					$\langle p_\mathrm{T}\rangle$	$\langle\theta\rangle$	$d^2\sigma/dp\,d\Omega$				
0.30–0.36	0.329	45.0	32.30	±	0.99	±	1.69							
0.36–0.42	0.389	45.1	31.21	±	0.97	±	1.65	0.389	55.0	29.76	±	0.95	±	1.61
0.42–0.50	0.458	44.9	26.21	±	0.79	±	1.22	0.459	54.9	24.78	±	0.76	±	1.30
0.50–0.60	0.547	44.9	19.55	±	0.61	±	0.98	0.545	55.0	18.18	±	0.59	±	0.94
0.60–0.72	0.656	44.8	14.89	±	0.49	±	0.87	0.654	55.0	13.12	±	0.48	±	0.83
0.72–0.90	0.799	44.8	9.60	±	0.33	±	0.68	0.796	54.7	6.78	±	0.28	±	0.55
0.90–1.25	1.028	44.7	3.10	±	0.14	±	0.33	1.025	54.6	1.72	±	0.10	±	0.22
p_T	$60 < \theta < 75$							$75 < \theta < 90$						
	$\langle p_\mathrm{T}\rangle$	$\langle\theta\rangle$	$d^2\sigma/dp\,d\Omega$					$\langle p_\mathrm{T}\rangle$	$\langle\theta\rangle$	$d^2\sigma/dp\,d\Omega$				
0.36–0.42	0.391	67.2	28.20	±	0.74	±	1.21							
0.42–0.50	0.461	67.3	24.13	±	0.62	±	1.06	0.459	81.9	16.51	±	0.50	±	0.85
0.50–0.60	0.549	67.2	17.32	±	0.47	±	0.83	0.548	81.9	10.75	±	0.37	±	0.72
0.60–0.72	0.657	67.2	10.56	±	0.35	±	0.70	0.659	81.9	4.87	±	0.24	±	0.48
0.72–0.90	0.801	66.8	3.97	±	0.17	±	0.40	0.803	81.3	1.78	±	0.12	±	0.24
0.90–1.25	1.039	66.9	0.80	±	0.06	±	0.14	1.031	81.4	0.33	±	0.04	±	0.07
p_T	$90 < \theta < 105$							$105 < \theta < 125$						
	$\langle p_\mathrm{T}\rangle$	$\langle\theta\rangle$	$d^2\sigma/dp\,d\Omega$					$\langle p_\mathrm{T}\rangle$	$\langle\theta\rangle$	$d^2\sigma/dp\,d\Omega$				
0.36–0.42								0.388	113.8	7.25	±	0.32	±	0.54
0.42–0.50	0.459	96.9	9.72	±	0.37	±	0.80	0.458	113.3	4.57	±	0.22	±	0.42
0.50–0.60	0.546	97.0	5.52	±	0.26	±	0.56	0.546	113.0	2.00	±	0.14	±	0.27
0.60–0.72	0.659	96.6	2.20	±	0.16	±	0.29	0.657	112.9	0.55	±	0.07	±	0.14
0.72–0.90	0.803	96.6	0.63	±	0.08	±	0.13	0.794	111.9	0.12	±	0.03	±	0.05
0.90–1.25	1.032	96.2	0.08	±	0.02	±	0.03							

Table A.14 Double-differential inclusive cross-section $d^2\sigma/dp\,d\Omega$ [mb/(GeV/c sr)] of the production of π^+'s in $\pi^+ + \mathrm{Be} \to \pi^+ + \mathrm{X}$ interactions with +5.0 GeV/c beam momentum; the first error is statistical, the second systematic; p_T in GeV/c, polar angle θ in degrees

p_T	$20 < \theta < 30$							$30 < \theta < 40$						
	$\langle p_T \rangle$	$\langle \theta \rangle$	$d^2\sigma/dp\,d\Omega$					$\langle p_T \rangle$	$\langle \theta \rangle$	$d^2\sigma/dp\,d\Omega$				
0.10–0.13	0.115	25.0	42.31	±	1.93	±	4.05	0.115	34.8	36.97	±	1.85	±	3.45
0.13–0.16	0.146	24.9	58.31	±	2.13	±	4.42	0.145	35.0	48.46	±	1.93	±	3.70
0.16–0.20	0.181	24.8	68.61	±	1.91	±	4.17	0.180	34.7	52.84	±	1.67	±	3.25
0.20–0.24	0.220	24.7	73.75	±	1.89	±	3.96	0.221	34.8	55.36	±	1.67	±	3.06
0.24–0.30	0.269	24.7	77.78	±	1.61	±	3.42	0.270	34.7	56.69	±	1.37	±	2.60
0.30–0.36	0.329	24.9	66.69	±	1.48	±	2.70	0.329	34.8	49.78	±	1.27	±	2.19
0.36–0.42	0.389	24.7	59.86	±	1.42	±	2.49	0.389	34.8	46.53	±	1.24	±	2.06
0.42–0.50	0.458	24.8	48.91	±	1.11	±	2.14	0.459	34.8	35.48	±	0.96	±	1.59
0.50–0.60	0.547	24.8	31.94	±	0.76	±	1.90	0.546	34.6	23.41	±	0.66	±	1.40
0.60–0.72	0.655	24.9	17.89	±	0.49	±	1.53	0.655	34.4	12.85	±	0.41	±	1.09
0.72–0.90								0.798	34.7	6.48	±	0.24	±	0.79
p_T	$40 < \theta < 50$							$50 < \theta < 60$						
	$\langle p_T \rangle$	$\langle \theta \rangle$	$d^2\sigma/dp\,d\Omega$					$\langle p_T \rangle$	$\langle \theta \rangle$	$d^2\sigma/dp\,d\Omega$				
0.10–0.13	0.116	45.1	32.76	±	1.81	±	3.26							
0.13–0.16	0.145	44.8	36.22	±	1.69	±	2.79	0.146	54.7	27.92	±	1.52	±	2.32
0.16–0.20	0.180	44.8	40.05	±	1.49	±	2.59	0.180	54.9	34.30	±	1.37	±	2.34
0.20–0.24	0.220	44.9	45.24	±	1.54	±	2.63	0.220	54.9	34.14	±	1.35	±	2.23
0.24–0.30	0.271	44.7	41.47	±	1.19	±	1.95	0.269	54.8	30.07	±	1.02	±	1.57
0.30–0.36	0.330	44.7	36.64	±	1.12	±	1.60	0.328	54.6	26.84	±	0.96	±	1.28
0.36–0.42	0.388	44.6	33.64	±	1.08	±	1.50	0.388	54.8	23.40	±	0.92	±	1.24
0.42–0.50	0.458	44.7	24.32	±	0.79	±	1.14	0.458	54.7	15.27	±	0.61	±	0.90
0.50–0.60	0.546	44.5	14.69	±	0.52	±	0.91	0.547	54.7	11.27	±	0.46	±	0.83
0.60–0.72	0.655	44.5	8.97	±	0.37	±	0.74	0.656	54.6	5.92	±	0.30	±	0.56
0.72–0.90	0.792	44.3	3.99	±	0.19	±	0.46	0.803	54.3	3.18	±	0.19	±	0.39
0.90–1.25								1.026	54.2	0.69	±	0.06	±	0.13
p_T	$60 < \theta < 75$							$75 < \theta < 90$						
	$\langle p_T \rangle$	$\langle \theta \rangle$	$d^2\sigma/dp\,d\Omega$					$\langle p_T \rangle$	$\langle \theta \rangle$	$d^2\sigma/dp\,d\Omega$				
0.13–0.16	0.146	67.1	23.55	±	1.12	±	1.93	0.146	82.6	20.77	±	1.07	±	1.80
0.16–0.20	0.181	67.2	28.89	±	1.02	±	1.94	0.181	82.4	20.75	±	0.87	±	1.35
0.20–0.24	0.221	67.1	29.33	±	1.03	±	1.87	0.220	82.4	18.97	±	0.83	±	1.17
0.24–0.30	0.269	67.0	21.83	±	0.72	±	1.11	0.269	82.5	14.12	±	0.59	±	0.78
0.30–0.36	0.330	66.9	17.07	±	0.63	±	0.83	0.330	82.1	11.05	±	0.50	±	0.71
0.36–0.42	0.391	66.6	14.13	±	0.56	±	0.81	0.391	82.1	7.59	±	0.41	±	0.58
0.42–0.50	0.458	66.8	10.28	±	0.41	±	0.69	0.460	81.9	5.40	±	0.30	±	0.46
0.50–0.60	0.549	66.4	6.46	±	0.29	±	0.53	0.549	81.7	3.37	±	0.21	±	0.35
0.60–0.72	0.658	66.5	3.71	±	0.20	±	0.40	0.657	81.2	1.88	±	0.15	±	0.25
0.72–0.90	0.799	66.1	1.54	±	0.11	±	0.21	0.791	81.8	0.50	±	0.06	±	0.10
0.90–1.25	1.040	66.3	0.23	±	0.02	±	0.05	1.008	80.8	0.06	±	0.01	±	0.02

Table A.14 (*Continued*)

p_T	$90 < \theta < 105$							$105 < \theta < 125$						
	$\langle p_T \rangle$	$\langle \theta \rangle$	$d^2\sigma/dp\,d\Omega$					$\langle p_T \rangle$	$\langle \theta \rangle$	$d^2\sigma/dp\,d\Omega$				
0.13–0.16	0.146	97.3	19.16	±	1.04	±	1.63	0.145	114.8	16.24	±	0.82	±	1.32
0.16–0.20	0.180	96.9	19.87	±	0.87	±	1.24	0.180	113.9	13.80	±	0.62	±	0.93
0.20–0.24	0.219	97.0	15.37	±	0.75	±	0.98	0.218	114.4	9.21	±	0.50	±	0.76
0.24–0.30	0.269	97.1	10.66	±	0.50	±	0.69	0.269	113.9	5.49	±	0.31	±	0.47
0.30–0.36	0.329	96.8	6.28	±	0.38	±	0.50	0.327	113.7	3.74	±	0.26	±	0.38
0.36–0.42	0.390	97.0	4.88	±	0.33	±	0.48	0.386	113.5	1.95	±	0.18	±	0.27
0.42–0.50	0.460	96.7	3.43	±	0.24	±	0.39	0.460	112.7	1.19	±	0.12	±	0.20
0.50–0.60	0.544	96.8	1.59	±	0.15	±	0.23	0.542	112.1	0.28	±	0.05	±	0.09
0.60–0.72	0.657	96.4	0.46	±	0.07	±	0.10	0.656	110.7	0.14	±	0.03	±	0.07
0.72–0.90	0.792	95.9	0.10	±	0.02	±	0.03							

Table A.15 Double-differential inclusive cross-section $d^2\sigma/dp\,d\Omega$ [mb/(GeV/c sr)] of the production of π^-'s in $\pi^+ + \mathrm{Be} \to \pi^- + \mathrm{X}$ interactions with +5.0 GeV/c beam momentum; the first error is statistical, the second systematic; p_T in GeV/c, polar angle θ in degrees

p_T	$20 < \theta < 30$							$30 < \theta < 40$						
	$\langle p_T \rangle$	$\langle \theta \rangle$	$d^2\sigma/dp\,d\Omega$					$\langle p_T \rangle$	$\langle \theta \rangle$	$d^2\sigma/dp\,d\Omega$				
0.10–0.13	0.115	24.8	39.31	±	1.81	±	4.02	0.115	34.5	33.52	±	1.71	±	3.42
0.13–0.16	0.145	24.8	47.64	±	1.88	±	4.01	0.145	34.8	36.33	±	1.66	±	3.22
0.16–0.20	0.180	24.6	53.08	±	1.62	±	3.40	0.180	34.7	36.96	±	1.38	±	2.60
0.20–0.24	0.221	24.6	55.02	±	1.64	±	3.20	0.220	34.7	40.08	±	1.40	±	2.55
0.24–0.30	0.270	24.4	47.90	±	1.23	±	2.37	0.270	34.5	35.56	±	1.06	±	1.92
0.30–0.36	0.329	24.8	40.67	±	1.15	±	1.91	0.329	34.7	29.35	±	0.96	±	1.62
0.36–0.42	0.389	24.9	35.08	±	1.08	±	1.77	0.389	34.6	22.84	±	0.85	±	1.23
0.42–0.50	0.457	24.7	26.10	±	0.83	±	1.44	0.456	34.8	17.25	±	0.66	±	1.03
0.50–0.60	0.547	25.0	12.95	±	0.50	±	0.89	0.545	34.6	10.78	±	0.45	±	0.79
0.60–0.72	0.652	24.8	7.87	±	0.35	±	0.73	0.651	34.7	5.75	±	0.30	±	0.57
0.72–0.90								0.796	34.9	2.74	±	0.18	±	0.34
p_T	$40 < \theta < 50$							$50 < \theta < 60$						
	$\langle p_T \rangle$	$\langle \theta \rangle$	$d^2\sigma/dp\,d\Omega$					$\langle p_T \rangle$	$\langle \theta \rangle$	$d^2\sigma/dp\,d\Omega$				
0.10–0.13	0.116	44.7	24.87	±	1.51	±	2.68							
0.13–0.16	0.145	44.8	27.53	±	1.46	±	2.34	0.145	54.7	22.78	±	1.31	±	2.11
0.16–0.20	0.180	44.6	27.67	±	1.21	±	2.02	0.180	54.5	23.64	±	1.13	±	1.87
0.20–0.24	0.220	44.7	26.37	±	1.14	±	1.82	0.220	54.9	22.43	±	1.06	±	1.75
0.24–0.30	0.269	44.8	25.96	±	0.94	±	1.43	0.271	54.7	20.51	±	0.83	±	1.24
0.30–0.36	0.329	44.7	21.55	±	0.83	±	1.17	0.330	54.7	16.40	±	0.74	±	1.03
0.36–0.42	0.389	44.8	17.95	±	0.78	±	1.01	0.389	54.6	14.18	±	0.70	±	0.93
0.42–0.50	0.456	44.6	13.69	±	0.59	±	0.83	0.456	54.9	9.04	±	0.47	±	0.66
0.50–0.60	0.546	44.6	8.04	±	0.39	±	0.62	0.544	54.7	6.05	±	0.34	±	0.60
0.60–0.72	0.653	44.7	4.49	±	0.27	±	0.47	0.654	54.5	3.34	±	0.24	±	0.40
0.72–0.90	0.792	44.7	2.05	±	0.16	±	0.27	0.799	54.6	1.48	±	0.13	±	0.22
0.90–1.25								1.015	54.6	0.36	±	0.04	±	0.08

Table A.15 (*Continued*)

p_T	$60 < \theta < 75$							$75 < \theta < 90$						
	$\langle p_T \rangle$	$\langle \theta \rangle$	$d^2\sigma/dp\,d\Omega$					$\langle p_T \rangle$	$\langle \theta \rangle$	$d^2\sigma/dp\,d\Omega$				
0.13–0.16	0.145	67.0	20.23	±	1.03	±	1.78	0.146	82.5	15.76	±	0.91	±	1.44
0.16–0.20	0.179	67.0	19.37	±	0.83	±	1.39	0.179	82.4	16.64	±	0.77	±	1.18
0.20–0.24	0.219	67.3	16.20	±	0.74	±	1.17	0.218	82.2	13.44	±	0.69	±	0.98
0.24–0.30	0.267	66.9	14.82	±	0.57	±	0.86	0.269	82.1	9.55	±	0.47	±	0.61
0.30–0.36	0.329	67.0	11.16	±	0.50	±	0.67	0.329	82.4	7.24	±	0.40	±	0.56
0.36–0.42	0.388	67.1	8.44	±	0.44	±	0.61	0.387	82.1	4.66	±	0.32	±	0.46
0.42–0.50	0.454	66.8	6.11	±	0.32	±	0.50	0.456	81.9	3.37	±	0.23	±	0.36
0.50–0.60	0.539	67.1	3.67	±	0.22	±	0.36	0.540	81.6	2.13	±	0.17	±	0.27
0.60–0.72	0.646	66.6	2.23	±	0.16	±	0.27	0.653	80.8	1.05	±	0.12	±	0.17
0.72–0.90	0.784	66.3	0.94	±	0.09	±	0.15	0.784	81.9	0.37	±	0.05	±	0.09
0.90–1.25	1.011	65.9	0.15	±	0.02	±	0.05	1.015	82.7	0.03	±	0.01	±	0.02
p_T	$90 < \theta < 105$							$105 < \theta < 125$						
	$\langle p_T \rangle$	$\langle \theta \rangle$	$d^2\sigma/dp\,d\Omega$					$\langle p_T \rangle$	$\langle \theta \rangle$	$d^2\sigma/dp\,d\Omega$				
0.13–0.16	0.145	96.7	15.55	±	0.92	±	1.48	0.145	114.5	12.24	±	0.70	±	1.11
0.16–0.20	0.179	97.3	13.18	±	0.70	±	0.96	0.178	114.0	9.88	±	0.52	±	0.77
0.20–0.24	0.217	97.2	9.96	±	0.60	±	0.80	0.218	114.1	7.30	±	0.44	±	0.70
0.24–0.30	0.268	96.6	7.43	±	0.41	±	0.57	0.267	114.2	4.38	±	0.28	±	0.44
0.30–0.36	0.328	96.2	4.13	±	0.30	±	0.42	0.326	113.5	2.46	±	0.21	±	0.30
0.36–0.42	0.387	97.2	2.84	±	0.25	±	0.35	0.381	112.6	1.57	±	0.17	±	0.24
0.42–0.50	0.456	96.9	2.18	±	0.19	±	0.30	0.453	113.1	0.87	±	0.10	±	0.18
0.50–0.60	0.539	97.4	1.08	±	0.12	±	0.18	0.538	112.2	0.40	±	0.06	±	0.14
0.60–0.72	0.653	94.8	0.37	±	0.06	±	0.10	0.658	111.9	0.06	±	0.02	±	0.04
0.72–0.90	0.791	95.7	0.04	±	0.02	±	0.03							

Table A.16 Double-differential inclusive cross-section $d^2\sigma/dp\,d\Omega$ [mb/(GeV/c sr)] of the production of protons in $\pi^- + \mathrm{Be} \to \mathrm{p} + \mathrm{X}$ interactions with -5.0 GeV/c beam momentum; the first error is statistical, the second systematic; p_T in GeV/c, polar angle θ in degrees

p_T	$20 < \theta < 30$							$30 < \theta < 40$						
	$\langle p_\mathrm{T}\rangle$	$\langle\theta\rangle$	$d^2\sigma/dp\,d\Omega$					$\langle p_\mathrm{T}\rangle$	$\langle\theta\rangle$	$d^2\sigma/dp\,d\Omega$				
0.20–0.24	0.217	25.0	33.01	±	1.18	±	2.52							
0.24–0.30	0.265	24.9	30.80	±	0.92	±	1.93	0.265	34.7	27.93	±	0.85	±	1.81
0.30–0.36	0.323	25.1	28.41	±	0.89	±	1.65	0.323	34.9	27.26	±	0.85	±	1.50
0.36–0.42	0.381	25.1	25.33	±	0.83	±	1.39	0.381	34.8	22.35	±	0.78	±	1.25
0.42–0.50	0.445	24.9	24.57	±	0.70	±	1.20	0.447	34.9	19.39	±	0.62	±	1.01
0.50–0.60	0.530	24.9	18.14	±	0.53	±	0.90	0.529	35.0	15.80	±	0.51	±	0.82
0.60–0.72	0.630	25.0	14.01	±	0.42	±	0.80	0.633	34.9	12.53	±	0.42	±	0.73
0.72–0.90								0.764	35.0	7.80	±	0.27	±	0.61
p_T	$40 < \theta < 50$							$50 < \theta < 60$						
	$\langle p_\mathrm{T}\rangle$	$\langle\theta\rangle$	$d^2\sigma/dp\,d\Omega$					$\langle p_\mathrm{T}\rangle$	$\langle\theta\rangle$	$d^2\sigma/dp\,d\Omega$				
0.30–0.36	0.330	45.1	22.87	±	0.75	±	1.28							
0.36–0.42	0.388	45.2	22.59	±	0.76	±	1.28	0.389	54.9	21.50	±	0.72	±	1.13
0.42–0.50	0.458	45.2	18.42	±	0.61	±	0.97	0.459	54.9	18.94	±	0.61	±	1.01
0.50–0.60	0.548	44.9	14.52	±	0.50	±	0.79	0.548	55.0	12.04	±	0.45	±	0.72
0.60–0.72	0.655	45.0	10.32	±	0.39	±	0.66	0.653	54.9	8.46	±	0.36	±	0.62
0.72–0.90	0.800	45.0	5.60	±	0.24	±	0.47	0.798	54.8	4.78	±	0.23	±	0.44
0.90–1.25	1.029	44.9	1.92	±	0.10	±	0.23	1.036	54.7	1.19	±	0.08	±	0.18
p_T	$60 < \theta < 75$							$75 < \theta < 90$						
	$\langle p_\mathrm{T}\rangle$	$\langle\theta\rangle$	$d^2\sigma/dp\,d\Omega$					$\langle p_\mathrm{T}\rangle$	$\langle\theta\rangle$	$d^2\sigma/dp\,d\Omega$				
0.36–0.42	0.389	67.7	20.57	±	0.85	±	1.12							
0.42–0.50	0.458	67.5	17.79	±	0.48	±	0.74	0.458	81.9	13.29	±	0.40	±	0.74
0.50–0.60	0.546	67.2	12.81	±	0.38	±	0.65	0.547	81.7	7.92	±	0.28	±	0.56
0.60–0.72	0.654	67.0	7.26	±	0.26	±	0.55	0.654	81.8	3.20	±	0.18	±	0.38
0.72–0.90	0.794	67.0	2.99	±	0.15	±	0.34	0.799	81.7	1.38	±	0.11	±	0.23
0.90–1.25	1.035	66.7	0.71	±	0.06	±	0.14	1.033	81.3	0.25	±	0.03	±	0.08
p_T	$90 < \theta < 105$							$105 < \theta < 125$						
	$\langle p_\mathrm{T}\rangle$	$\langle\theta\rangle$	$d^2\sigma/dp\,d\Omega$					$\langle p_\mathrm{T}\rangle$	$\langle\theta\rangle$	$d^2\sigma/dp\,d\Omega$				
0.36–0.42								0.388	113.8	5.82	±	0.26	±	0.47
0.42–0.50	0.456	96.9	7.12	±	0.29	±	0.55	0.455	113.5	3.35	±	0.17	±	0.29
0.50–0.60	0.547	96.1	3.69	±	0.19	±	0.38	0.545	112.7	1.35	±	0.11	±	0.19
0.60–0.72	0.652	95.8	1.24	±	0.12	±	0.21	0.642	111.6	0.20	±	0.04	±	0.08
0.72–0.90	0.790	95.5	0.39	±	0.06	±	0.12	0.790	113.9	0.07	±	0.02	±	0.06
0.90–1.25	1.027	94.2	0.07	±	0.02	±	0.06							

Table A.17 Double-differential inclusive cross-section $d^2\sigma/dp\,d\Omega$ [mb/(GeV/c sr)] of the production of π^+'s in $\pi^- + \mathrm{Be} \to \pi^+ + \mathrm{X}$ interactions with -5.0 GeV/c beam momentum; the first error is statistical, the second systematic; p_T in GeV/c, polar angle θ in degrees

p_T	$20 < \theta < 30$							$30 < \theta < 40$						
	$\langle p_\mathrm{T}\rangle$	$\langle\theta\rangle$	$d^2\sigma/dp\,d\Omega$					$\langle p_\mathrm{T}\rangle$	$\langle\theta\rangle$	$d^2\sigma/dp\,d\Omega$				
0.10–0.13	0.115	24.9	33.00	±	1.51	±	3.18	0.115	34.7	27.01	±	1.43	±	2.80
0.13–0.16	0.145	24.8	43.98	±	1.64	±	3.42	0.143	34.9	32.52	±	1.40	±	2.65
0.16–0.20	0.179	24.5	50.11	±	1.43	±	3.04	0.178	34.6	36.54	±	1.26	±	2.44
0.20–0.24	0.217	24.7	54.94	±	1.48	±	3.04	0.217	34.6	36.76	±	1.19	±	2.15
0.24–0.30	0.265	24.7	52.93	±	1.20	±	2.40	0.265	34.6	36.68	±	0.98	±	1.79
0.30–0.36	0.323	24.6	44.13	±	1.07	±	1.87	0.323	34.6	30.76	±	0.89	±	1.42
0.36–0.42	0.380	24.7	37.58	±	0.99	±	1.57	0.380	34.6	24.16	±	0.78	±	1.20
0.42–0.50	0.445	24.7	28.54	±	0.76	±	1.39	0.446	34.8	23.02	±	0.71	±	1.24
0.50–0.60	0.530	24.7	16.58	±	0.49	±	1.09	0.529	34.8	13.34	±	0.45	±	0.93
0.60–0.72	0.632	24.9	9.14	±	0.31	±	0.85	0.629	34.8	7.58	±	0.29	±	0.74
0.72–0.90								0.763	34.8	3.37	±	0.16	±	0.46
p_T	$40 < \theta < 50$							$50 < \theta < 60$						
	$\langle p_\mathrm{T}\rangle$	$\langle\theta\rangle$	$d^2\sigma/dp\,d\Omega$					$\langle p_\mathrm{T}\rangle$	$\langle\theta\rangle$	$d^2\sigma/dp\,d\Omega$				
0.10–0.13	0.117	45.1	23.14	±	1.34	±	2.64							
0.13–0.16	0.145	44.8	25.22	±	1.27	±	2.17	0.146	54.3	20.21	±	1.12	±	1.88
0.16–0.20	0.180	44.7	27.78	±	1.09	±	1.98	0.179	54.8	23.74	±	1.04	±	1.85
0.20–0.24	0.219	44.8	27.37	±	1.05	±	1.97	0.219	54.6	22.27	±	0.97	±	1.63
0.24–0.30	0.270	44.7	25.38	±	0.83	±	1.40	0.270	54.7	19.38	±	0.72	±	1.14
0.30–0.36	0.329	44.7	22.78	±	0.77	±	1.16	0.329	54.7	17.75	±	0.70	±	0.94
0.36–0.42	0.388	44.9	19.22	±	0.73	±	0.98	0.390	54.7	13.10	±	0.61	±	0.74
0.42–0.50	0.457	44.8	14.34	±	0.55	±	0.75	0.458	54.9	10.81	±	0.47	±	0.68
0.50–0.60	0.544	44.9	8.70	±	0.37	±	0.59	0.546	54.6	6.19	±	0.31	±	0.49
0.60–0.72	0.652	44.6	4.70	±	0.24	±	0.44	0.655	55.0	3.56	±	0.22	±	0.38
0.72–0.90	0.799	44.3	2.36	±	0.13	±	0.31	0.797	54.4	1.34	±	0.10	±	0.18
0.90–1.25								1.022	54.5	0.39	±	0.03	±	0.09
p_T	$60 < \theta < 75$							$75 < \theta < 90$						
	$\langle p_\mathrm{T}\rangle$	$\langle\theta\rangle$	$d^2\sigma/dp\,d\Omega$					$\langle p_\mathrm{T}\rangle$	$\langle\theta\rangle$	$d^2\sigma/dp\,d\Omega$				
0.13–0.16	0.145	67.4	16.41	±	0.84	±	1.43	0.145	82.6	14.39	±	0.78	±	1.41
0.16–0.20	0.180	67.4	18.12	±	0.72	±	1.30	0.181	82.1	14.48	±	0.65	±	1.09
0.20–0.24	0.220	67.0	15.53	±	0.65	±	1.08	0.220	82.6	12.97	±	0.61	±	0.92
0.24–0.30	0.269	67.0	14.54	±	0.53	±	0.80	0.269	82.2	10.19	±	0.45	±	0.66
0.30–0.36	0.329	66.9	10.50	±	0.45	±	0.58	0.329	82.0	6.22	±	0.34	±	0.45
0.36–0.42	0.388	66.8	8.80	±	0.40	±	0.55	0.388	82.2	4.95	±	0.30	±	0.42
0.42–0.50	0.458	67.0	6.64	±	0.30	±	0.46	0.457	82.1	3.35	±	0.21	±	0.31
0.50–0.60	0.544	66.6	4.12	±	0.21	±	0.36	0.545	81.5	2.13	±	0.15	±	0.25
0.60–0.72	0.652	66.8	1.94	±	0.13	±	0.23	0.652	81.6	1.12	±	0.10	±	0.17
0.72–0.90	0.786	66.5	0.71	±	0.06	±	0.11	0.792	80.7	0.20	±	0.03	±	0.05
0.90–1.25	1.026	65.7	0.12	±	0.02	±	0.04	1.000	79.8	0.04	±	0.01	±	0.03

Table A.17 (*Continued*)

p_T	$90 < \theta < 105$							$105 < \theta < 125$						
	$\langle p_T \rangle$	$\langle \theta \rangle$	$d^2\sigma/dp\,d\Omega$					$\langle p_T \rangle$	$\langle \theta \rangle$	$d^2\sigma/dp\,d\Omega$				
0.13–0.16	0.145	97.9	11.04	±	0.69	±	1.04	0.145	114.8	11.76	±	0.62	±	1.01
0.16–0.20	0.179	97.6	12.33	±	0.62	±	0.92	0.179	114.7	8.52	±	0.43	±	0.61
0.20–0.24	0.218	97.3	11.46	±	0.58	±	0.88	0.218	114.5	6.71	±	0.38	±	0.58
0.24–0.30	0.269	97.0	5.59	±	0.32	±	0.45	0.269	113.9	4.11	±	0.25	±	0.34
0.30–0.36	0.329	97.1	3.98	±	0.28	±	0.37	0.328	113.6	2.55	±	0.19	±	0.30
0.36–0.42	0.387	96.4	2.91	±	0.22	±	0.32	0.387	113.2	1.51	±	0.15	±	0.23
0.42–0.50	0.456	96.5	2.12	±	0.18	±	0.28	0.453	113.7	0.50	±	0.07	±	0.09
0.50–0.60	0.547	96.5	0.95	±	0.10	±	0.17	0.528	112.1	0.18	±	0.04	±	0.07
0.60–0.72	0.650	96.6	0.33	±	0.05	±	0.11	0.646	109.7	0.04	±	0.02	±	0.02
0.72–0.90	0.775	95.5	0.07	±	0.02	±	0.03							

Table A.18 Double-differential inclusive cross-section $d^2\sigma/dp\,d\Omega$ [mb/(GeV/c sr)] of the production of π^-'s in $\pi^- + \mathrm{Be} \to \pi^- + \mathrm{X}$ interactions with -5.0 GeV/c beam momentum; the first error is statistical, the second systematic; p_T in GeV/c, polar angle θ in degrees

p_T	$20 < \theta < 30$							$30 < \theta < 40$						
	$\langle p_T \rangle$	$\langle \theta \rangle$	$d^2\sigma/dp\,d\Omega$					$\langle p_T \rangle$	$\langle \theta \rangle$	$d^2\sigma/dp\,d\Omega$				
0.10–0.13	0.117	24.8	62.37	±	2.16	±	5.74	0.117	34.8	48.21	±	1.91	±	4.36
0.13–0.16	0.147	24.8	76.32	±	2.20	±	5.52	0.146	34.9	61.93	±	1.99	±	4.39
0.16–0.20	0.182	24.7	83.55	±	1.87	±	4.73	0.182	34.9	62.67	±	1.65	±	3.65
0.20–0.24	0.223	24.8	85.60	±	1.86	±	4.23	0.223	34.8	65.86	±	1.66	±	3.39
0.24–0.30	0.274	24.8	84.03	±	1.51	±	3.48	0.274	34.8	61.12	±	1.25	±	2.60
0.30–0.36	0.335	24.7	76.28	±	1.44	±	2.75	0.336	34.7	56.80	±	1.22	±	2.27
0.36–0.42	0.398	24.8	62.57	±	1.32	±	2.34	0.400	34.8	46.82	±	1.12	±	1.91
0.42–0.50	0.471	24.8	50.57	±	1.04	±	2.31	0.472	34.8	37.67	±	0.88	±	1.73
0.50–0.60	0.563	24.7	32.88	±	0.72	±	1.87	0.564	34.7	23.45	±	0.61	±	1.39
0.60–0.72	0.682	24.8	20.81	±	0.52	±	1.62	0.681	34.6	13.46	±	0.41	±	1.09
0.72–0.90								0.833	34.4	6.88	±	0.25	±	0.73
p_T	$40 < \theta < 50$							$50 < \theta < 60$						
	$\langle p_T \rangle$	$\langle \theta \rangle$	$d^2\sigma/dp\,d\Omega$					$\langle p_T \rangle$	$\langle \theta \rangle$	$d^2\sigma/dp\,d\Omega$				
0.10–0.13	0.115	44.9	40.66	±	1.85	±	3.91							
0.13–0.16	0.145	45.0	46.69	±	1.72	±	3.41	0.146	55.0	39.53	±	1.61	±	3.02
0.16–0.20	0.180	44.9	48.40	±	1.47	±	2.96	0.180	54.7	39.50	±	1.32	±	2.52
0.20–0.24	0.220	44.8	51.14	±	1.49	±	2.77	0.220	54.8	39.04	±	1.29	±	2.29
0.24–0.30	0.270	44.7	46.15	±	1.14	±	2.03	0.269	54.7	36.30	±	1.01	±	1.76
0.30–0.36	0.329	44.8	41.24	±	1.06	±	1.68	0.330	54.7	28.89	±	0.89	±	1.25
0.36–0.42	0.388	44.7	31.58	±	0.92	±	1.32	0.389	54.8	24.62	±	0.84	±	1.18
0.42–0.50	0.457	44.7	26.31	±	0.74	±	1.28	0.458	54.7	16.87	±	0.58	±	0.98
0.50–0.60	0.546	44.7	17.44	±	0.53	±	1.12	0.546	54.6	10.96	±	0.41	±	0.81
0.60–0.72	0.652	44.7	9.12	±	0.34	±	0.80	0.652	54.7	6.94	±	0.31	±	0.66
0.72–0.90	0.798	44.5	4.34	±	0.20	±	0.50	0.790	54.6	2.73	±	0.16	±	0.33
0.90–1.25								1.015	54.7	0.67	±	0.06	±	0.12

Table A.18 (*Continued*)

p_T	$60 < \theta < 75$							$75 < \theta < 90$						
	$\langle p_T \rangle$	$\langle \theta \rangle$	$d^2\sigma/dp\,d\Omega$					$\langle p_T \rangle$	$\langle \theta \rangle$	$d^2\sigma/dp\,d\Omega$				
0.13–0.16	0.146	67.2	30.13	±	1.14	±	2.19	0.145	82.5	26.15	±	1.05	±	2.03
0.16–0.20	0.180	67.4	32.26	±	0.98	±	1.86	0.179	82.4	28.40	±	0.91	±	1.66
0.20–0.24	0.220	67.1	30.28	±	0.95	±	1.67	0.220	82.2	24.92	±	0.86	±	1.34
0.24–0.30	0.268	67.0	23.68	±	0.67	±	1.02	0.269	82.1	16.88	±	0.57	±	0.81
0.30–0.36	0.329	66.8	19.13	±	0.60	±	0.84	0.328	81.8	12.14	±	0.48	±	0.70
0.36–0.42	0.389	67.1	15.73	±	0.54	±	0.84	0.389	81.7	8.58	±	0.39	±	0.64
0.42–0.50	0.459	66.9	10.41	±	0.37	±	0.67	0.458	81.6	6.55	±	0.30	±	0.56
0.50–0.60	0.544	66.5	7.04	±	0.27	±	0.58	0.547	81.5	3.33	±	0.19	±	0.35
0.60–0.72	0.652	66.8	3.77	±	0.19	±	0.40	0.650	80.8	1.82	±	0.13	±	0.25
0.72–0.90	0.790	66.4	1.60	±	0.10	±	0.22	0.787	81.2	0.39	±	0.05	±	0.08
0.90–1.25	1.032	67.0	0.18	±	0.02	±	0.04	0.992	79.4	0.03	±	0.01	±	0.02
p_T	$90 < \theta < 105$							$105 < \theta < 125$						
	$\langle p_T \rangle$	$\langle \theta \rangle$	$d^2\sigma/dp\,d\Omega$					$\langle p_T \rangle$	$\langle \theta \rangle$	$d^2\sigma/dp\,d\Omega$				
0.13–0.16	0.146	97.0	24.14	±	1.05	±	1.88	0.145	114.3	20.22	±	0.81	±	1.33
0.16–0.20	0.179	97.3	24.91	±	0.89	±	1.44	0.179	114.3	17.32	±	0.63	±	0.95
0.20–0.24	0.219	97.3	17.32	±	0.71	±	1.00	0.218	114.3	11.14	±	0.49	±	0.75
0.24–0.30	0.267	97.2	12.43	±	0.48	±	0.77	0.267	114.0	6.86	±	0.31	±	0.51
0.30–0.36	0.328	96.9	7.52	±	0.37	±	0.58	0.329	113.6	3.70	±	0.23	±	0.36
0.36–0.42	0.388	96.3	4.89	±	0.30	±	0.46	0.385	114.0	2.56	±	0.19	±	0.31
0.42–0.50	0.459	96.8	3.47	±	0.22	±	0.40	0.458	113.0	1.39	±	0.12	±	0.22
0.50–0.60	0.545	96.6	1.74	±	0.14	±	0.25	0.535	111.3	0.56	±	0.06	±	0.14
0.60–0.72	0.640	96.4	0.56	±	0.07	±	0.12	0.653	110.5	0.18	±	0.03	±	0.08
0.72–0.90	0.789	97.1	0.15	±	0.03	±	0.06							

Table A.19 Double-differential inclusive cross-section $d^2\sigma/dp\,d\Omega$ [mb/(GeV/c sr)] of the production of protons in p + Be → p + X interactions with +12.0 GeV/c beam momentum; the first error is statistical, the second systematic; p_T in GeV/c, polar angle θ in degrees

p_T	$20 < \theta < 30$							$30 < \theta < 40$						
	$\langle p_T \rangle$	$\langle \theta \rangle$	$d^2\sigma/dp\,d\Omega$					$\langle p_T \rangle$	$\langle \theta \rangle$	$d^2\sigma/dp\,d\Omega$				
0.20–0.24	0.220	24.8	42.26	±	1.72	±	2.32							
0.24–0.30	0.269	25.0	47.06	±	1.45	±	2.34	0.270	34.9	40.58	±	1.33	±	1.92
0.30–0.36	0.329	25.2	44.12	±	1.43	±	1.87	0.328	35.1	39.35	±	1.31	±	1.55
0.36–0.42	0.388	25.2	40.91	±	1.35	±	1.53	0.387	35.0	37.43	±	1.31	±	1.27
0.42–0.50	0.456	24.8	37.62	±	1.11	±	1.23	0.457	34.9	30.10	±	1.00	±	1.02
0.50–0.60	0.545	24.9	32.32	±	0.91	±	1.06	0.544	34.8	28.13	±	0.89	±	0.90
0.60–0.72	0.651	24.9	27.50	±	0.78	±	1.08	0.652	34.8	20.54	±	0.68	±	0.85
0.72–0.90								0.796	34.8	14.17	±	0.47	±	0.82
p_T	$40 < \theta < 50$							$50 < \theta < 60$						
	$\langle p_T \rangle$	$\langle \theta \rangle$	$d^2\sigma/dp\,d\Omega$					$\langle p_T \rangle$	$\langle \theta \rangle$	$d^2\sigma/dp\,d\Omega$				
0.30–0.36	0.328	44.9	37.76	±	1.30	±	1.37							
0.36–0.42	0.389	45.3	36.16	±	1.28	±	1.11	0.389	55.0	29.71	±	1.12	±	0.91
0.42–0.50	0.459	44.8	29.11	±	0.99	±	0.88	0.459	54.8	27.99	±	0.95	±	0.85
0.50–0.60	0.549	44.8	22.87	±	0.80	±	0.77	0.548	55.0	18.48	±	0.71	±	0.70
0.60–0.72	0.655	44.9	17.01	±	0.64	±	0.74	0.658	55.0	14.18	±	0.59	±	0.70
0.72–0.90	0.798	44.7	10.26	±	0.41	±	0.63	0.798	54.8	8.30	±	0.38	±	0.56
0.90–1.25	1.040	44.7	4.00	±	0.19	±	0.38	1.031	54.9	2.21	±	0.14	±	0.24
p_T	$60 < \theta < 75$							$75 < \theta < 90$						
	$\langle p_T \rangle$	$\langle \theta \rangle$	$d^2\sigma/dp\,d\Omega$					$\langle p_T \rangle$	$\langle \theta \rangle$	$d^2\sigma/dp\,d\Omega$				
0.36–0.42	0.393	67.1	26.96	±	0.83	±	1.02							
0.42–0.50	0.466	67.1	23.83	±	0.71	±	0.73	0.465	82.0	17.60	±	0.60	±	0.71
0.50–0.60	0.556	67.2	18.53	±	0.58	±	0.71	0.555	81.7	12.56	±	0.48	±	0.65
0.60–0.72	0.666	67.5	11.57	±	0.44	±	0.69	0.668	81.4	6.10	±	0.31	±	0.48
0.72–0.90	0.814	66.9	5.29	±	0.25	±	0.49	0.814	81.6	2.56	±	0.18	±	0.27
0.90–1.25	1.059	66.9	1.32	±	0.09	±	0.19	1.052	81.0	0.62	±	0.06	±	0.10
p_T	$90 < \theta < 105$							$105 < \theta < 125$						
	$\langle p_T \rangle$	$\langle \theta \rangle$	$d^2\sigma/dp\,d\Omega$					$\langle p_T \rangle$	$\langle \theta \rangle$	$d^2\sigma/dp\,d\Omega$				
0.36–0.42								0.393	113.4	7.70	±	0.40	±	0.32
0.42–0.50	0.462	97.0	10.79	±	0.49	±	0.62	0.462	113.2	4.28	±	0.26	±	0.23
0.50–0.60	0.553	96.6	5.52	±	0.31	±	0.40	0.551	112.6	2.52	±	0.20	±	0.24
0.60–0.72	0.660	96.8	2.69	±	0.22	±	0.26	0.664	111.9	0.68	±	0.10	±	0.10
0.72–0.90	0.814	95.8	1.00	±	0.11	±	0.12	0.804	112.0	0.21	±	0.04	±	0.05
0.90–1.25	1.013	95.6	0.30	±	0.05	±	0.05	1.070	112.1	0.05	±	0.02	±	0.02

Table A.20 Double-differential inclusive cross-section $d^2\sigma/dp\,d\Omega$ [mb/(GeV/c sr)] of the production of π^+'s in p + Be $\to \pi^+ +$ X interactions with +12.0 GeV/c beam momentum; the first error is statistical, the second systematic; p_T in GeV/c, polar angle θ in degrees

p_T	$20 < \theta < 30$							$30 < \theta < 40$						
	$\langle p_T \rangle$	$\langle \theta \rangle$	$d^2\sigma/dp\,d\Omega$					$\langle p_T \rangle$	$\langle \theta \rangle$	$d^2\sigma/dp\,d\Omega$				
0.10–0.13	0.116	24.5	56.17	±	2.74	±	4.10	0.116	34.9	37.64	±	2.12	±	2.76
0.13–0.16	0.145	24.6	68.54	±	2.74	±	3.99	0.146	34.7	49.10	±	2.30	±	2.82
0.16–0.20	0.180	24.4	81.06	±	2.45	±	3.93	0.180	34.7	59.23	±	2.18	±	2.84
0.20–0.24	0.220	24.6	89.45	±	2.60	±	3.70	0.219	34.7	57.42	±	2.05	±	2.36
0.24–0.30	0.269	24.6	87.39	±	2.08	±	3.02	0.269	34.8	58.85	±	1.70	±	1.99
0.30–0.36	0.328	24.7	72.09	±	1.84	±	2.14	0.329	34.6	44.45	±	1.44	±	1.29
0.36–0.42	0.387	24.6	57.37	±	1.63	±	1.67	0.388	34.7	40.10	±	1.39	±	1.13
0.42–0.50	0.455	24.7	44.57	±	1.24	±	1.58	0.456	34.7	29.50	±	0.99	±	0.97
0.50–0.60	0.541	24.8	29.37	±	0.88	±	1.50	0.544	34.7	20.26	±	0.74	±	0.95
0.60–0.72	0.653	24.5	18.38	±	0.62	±	1.42	0.650	34.7	11.91	±	0.48	±	0.84
0.72–0.90								0.793	34.4	5.37	±	0.24	±	0.60
p_T	$40 < \theta < 50$							$50 < \theta < 60$						
	$\langle p_T \rangle$	$\langle \theta \rangle$	$d^2\sigma/dp\,d\Omega$					$\langle p_T \rangle$	$\langle \theta \rangle$	$d^2\sigma/dp\,d\Omega$				
0.10–0.13	0.116	44.9	29.54	±	1.89	±	2.23							
0.13–0.16	0.145	45.1	31.65	±	1.79	±	1.86	0.146	55.0	30.54	±	1.73	±	1.91
0.16–0.20	0.180	44.7	39.88	±	1.74	±	1.95	0.180	54.7	32.99	±	1.60	±	1.61
0.20–0.24	0.220	45.1	36.17	±	1.59	±	1.51	0.220	55.0	32.11	±	1.57	±	1.32
0.24–0.30	0.269	44.9	37.30	±	1.34	±	1.27	0.269	54.8	26.84	±	1.13	±	0.90
0.30–0.36	0.329	44.6	27.91	±	1.13	±	0.83	0.329	54.7	21.59	±	1.01	±	0.64
0.36–0.42	0.387	44.6	27.97	±	1.17	±	0.84	0.389	54.7	17.68	±	0.89	±	0.56
0.42–0.50	0.458	44.6	19.97	±	0.85	±	0.69	0.457	54.7	12.98	±	0.64	±	0.49
0.50–0.60	0.545	44.6	12.52	±	0.56	±	0.58	0.547	54.6	8.98	±	0.51	±	0.46
0.60–0.72	0.655	44.3	8.16	±	0.42	±	0.54	0.654	54.4	4.23	±	0.29	±	0.30
0.72–0.90	0.792	44.4	3.41	±	0.21	±	0.35	0.793	54.8	2.24	±	0.17	±	0.23
0.90–1.25								1.012	54.0	0.43	±	0.04	±	0.08
p_T	$60 < \theta < 75$							$75 < \theta < 90$						
	$\langle p_T \rangle$	$\langle \theta \rangle$	$d^2\sigma/dp\,d\Omega$					$\langle p_T \rangle$	$\langle \theta \rangle$	$d^2\sigma/dp\,d\Omega$				
0.13–0.16	0.146	67.2	18.07	±	1.05	±	1.18	0.146	82.6	14.65	±	0.92	±	1.00
0.16–0.20	0.181	67.2	23.29	±	1.06	±	1.14	0.181	82.3	17.94	±	0.93	±	0.96
0.20–0.24	0.221	67.2	22.23	±	1.04	±	0.89	0.221	81.9	15.36	±	0.80	±	0.59
0.24–0.30	0.272	67.3	20.62	±	0.80	±	0.67	0.271	82.0	11.32	±	0.58	±	0.36
0.30–0.36	0.333	66.7	15.24	±	0.71	±	0.47	0.332	81.9	8.92	±	0.52	±	0.30
0.36–0.42	0.396	66.5	10.73	±	0.56	±	0.37	0.395	81.8	6.43	±	0.44	±	0.28
0.42–0.50	0.464	67.0	7.43	±	0.40	±	0.33	0.465	82.3	4.08	±	0.30	±	0.23
0.50–0.60	0.555	66.3	4.91	±	0.29	±	0.30	0.553	81.8	2.81	±	0.23	±	0.22
0.60–0.72	0.666	66.4	3.29	±	0.23	±	0.28	0.661	81.3	1.49	±	0.16	±	0.16
0.72–0.90	0.806	66.1	0.96	±	0.09	±	0.12	0.813	82.8	0.33	±	0.05	±	0.05
0.90–1.25	1.043	65.3	0.17	±	0.02	±	0.04	1.030	81.1	0.09	±	0.02	±	0.02

Table A.20 (*Continued*)

p_T	$90 < \theta < 105$							$105 < \theta < 125$						
	$\langle p_T \rangle$	$\langle \theta \rangle$	$d^2\sigma/dp\,d\Omega$					$\langle p_T \rangle$	$\langle \theta \rangle$	$d^2\sigma/dp\,d\Omega$				
0.13–0.16	0.147	97.4	12.17	±	0.87	±	0.80	0.146	115.1	11.86	±	0.72	±	0.76
0.16–0.20	0.181	97.4	13.20	±	0.74	±	0.71	0.181	113.9	10.37	±	0.58	±	0.55
0.20–0.24	0.220	97.3	11.44	±	0.71	±	0.45	0.219	114.0	8.53	±	0.56	±	0.36
0.24–0.30	0.270	97.6	9.23	±	0.55	±	0.34	0.269	113.7	3.86	±	0.29	±	0.17
0.30–0.36	0.331	97.2	4.67	±	0.38	±	0.21	0.330	113.6	2.57	±	0.24	±	0.18
0.36–0.42	0.393	97.2	3.51	±	0.33	±	0.22	0.393	113.6	1.53	±	0.17	±	0.13
0.42–0.50	0.466	96.3	2.68	±	0.25	±	0.22	0.459	113.7	0.67	±	0.10	±	0.08
0.50–0.60	0.550	96.1	0.95	±	0.12	±	0.11	0.563	112.5	0.26	±	0.06	±	0.04
0.60–0.72	0.662	96.1	0.30	±	0.06	±	0.05	0.669	108.6	0.08	±	0.03	±	0.02
0.72–0.90	0.812	97.0	0.11	±	0.03	±	0.02							

Table A.21 Double-differential inclusive cross-section $d^2\sigma/dp\,d\Omega$ [mb/(GeV/c sr)] of the production of π^-'s in $p + Be \to \pi^- + X$ interactions with +12.0 GeV/c beam momentum; the first error is statistical, the second systematic; p_T in GeV/c, polar angle θ in degrees

p_T	$20 < \theta < 30$							$30 < \theta < 40$						
	$\langle p_T \rangle$	$\langle \theta \rangle$	$d^2\sigma/dp\,d\Omega$					$\langle p_T \rangle$	$\langle \theta \rangle$	$d^2\sigma/dp\,d\Omega$				
0.10–0.13	0.116	24.7	63.15	±	2.80	±	4.48	0.115	34.6	36.61	±	1.99	±	2.85
0.13–0.16	0.146	24.8	73.93	±	2.87	±	4.28	0.146	34.8	50.78	±	2.28	±	3.02
0.16–0.20	0.180	24.6	75.32	±	2.35	±	3.65	0.181	34.5	54.11	±	1.94	±	2.67
0.20–0.24	0.220	24.6	86.26	±	2.56	±	3.50	0.220	34.8	57.19	±	2.04	±	2.36
0.24–0.30	0.270	24.6	71.03	±	1.84	±	2.33	0.270	34.8	50.41	±	1.55	±	1.67
0.30–0.36	0.330	24.8	60.88	±	1.71	±	1.70	0.331	34.8	42.13	±	1.42	±	1.19
0.36–0.42	0.391	24.9	46.35	±	1.50	±	1.33	0.390	34.8	35.09	±	1.30	±	1.01
0.42–0.50	0.460	24.6	34.68	±	1.11	±	1.25	0.458	34.7	22.92	±	0.86	±	0.81
0.50–0.60	0.550	24.8	24.77	±	0.85	±	1.25	0.548	35.0	16.44	±	0.70	±	0.81
0.60–0.72	0.657	24.7	12.69	±	0.54	±	0.91	0.658	34.9	7.61	±	0.39	±	0.53
0.72–0.90								0.805	35.1	3.67	±	0.23	±	0.37
p_T	$40 < \theta < 50$							$50 < \theta < 60$						
	$\langle p_T \rangle$	$\langle \theta \rangle$	$d^2\sigma/dp\,d\Omega$					$\langle p_T \rangle$	$\langle \theta \rangle$	$d^2\sigma/dp\,d\Omega$				
0.10–0.13	0.116	44.8	26.29	±	1.63	±	2.21							
0.13–0.16	0.145	44.8	31.91	±	1.69	±	2.00	0.144	54.9	29.42	±	1.74	±	2.00
0.16–0.20	0.180	44.9	42.89	±	1.85	±	2.15	0.179	55.0	28.79	±	1.41	±	1.44
0.20–0.24	0.220	45.1	36.82	±	1.59	±	1.55	0.219	54.7	30.71	±	1.48	±	1.27
0.24–0.30	0.269	44.7	35.90	±	1.32	±	1.21	0.269	54.8	25.32	±	1.10	±	0.84
0.30–0.36	0.329	44.5	28.51	±	1.12	±	0.82	0.329	54.7	17.52	±	0.84	±	0.52
0.36–0.42	0.390	44.7	23.91	±	1.06	±	0.73	0.388	54.6	16.15	±	0.86	±	0.53
0.42–0.50	0.458	44.6	15.10	±	0.67	±	0.57	0.455	54.8	9.68	±	0.55	±	0.41
0.50–0.60	0.545	44.7	9.36	±	0.47	±	0.50	0.547	54.8	7.63	±	0.46	±	0.44
0.60–0.72	0.653	45.0	5.50	±	0.36	±	0.41	0.653	54.5	3.63	±	0.27	±	0.29
0.72–0.90	0.793	44.8	2.16	±	0.17	±	0.23	0.785	54.5	1.51	±	0.14	±	0.16
0.90–1.25								1.021	54.3	0.21	±	0.03	±	0.04

Table A.21 (*Continued*)

p_T	$60 < \theta < 75$							$75 < \theta < 90$						
	$\langle p_T \rangle$	$\langle \theta \rangle$	$d^2\sigma/dp\,d\Omega$					$\langle p_T \rangle$	$\langle \theta \rangle$	$d^2\sigma/dp\,d\Omega$				
0.13–0.16	0.145	67.4	19.97	±	1.09	±	1.39	0.145	82.4	16.93	±	0.99	±	1.21
0.16–0.20	0.180	67.5	22.77	±	0.99	±	1.15	0.178	82.3	18.92	±	0.90	±	1.00
0.20–0.24	0.218	67.2	21.03	±	0.97	±	0.81	0.217	82.3	16.53	±	0.83	±	0.63
0.24–0.30	0.267	66.9	16.28	±	0.68	±	0.51	0.265	81.9	13.64	±	0.65	±	0.43
0.30–0.36	0.327	66.8	13.78	±	0.64	±	0.42	0.324	81.8	7.88	±	0.47	±	0.30
0.36–0.42	0.384	66.7	9.72	±	0.52	±	0.35	0.383	82.0	5.92	±	0.42	±	0.30
0.42–0.50	0.452	66.2	5.78	±	0.33	±	0.29	0.451	81.4	3.52	±	0.27	±	0.22
0.50–0.60	0.535	66.4	4.40	±	0.28	±	0.29	0.534	82.4	2.34	±	0.20	±	0.20
0.60–0.72	0.638	66.3	1.97	±	0.16	±	0.17	0.636	81.4	0.74	±	0.11	±	0.09
0.72–0.90	0.773	66.4	0.76	±	0.08	±	0.10	0.752	83.0	0.18	±	0.04	±	0.03
0.90–1.25	0.988	66.5	0.11	±	0.02	±	0.02	1.041	78.8	0.02	±	0.01	±	0.01
p_T	$90 < \theta < 105$							$105 < \theta < 125$						
	$\langle p_T \rangle$	$\langle \theta \rangle$	$d^2\sigma/dp\,d\Omega$					$\langle p_T \rangle$	$\langle \theta \rangle$	$d^2\sigma/dp\,d\Omega$				
0.13–0.16	0.144	97.3	15.64	±	0.95	±	1.21	0.145	114.2	13.59	±	0.73	±	1.01
0.16–0.20	0.179	96.9	13.02	±	0.69	±	0.78	0.178	114.4	8.83	±	0.47	±	0.53
0.20–0.24	0.218	96.6	10.87	±	0.66	±	0.47	0.218	113.7	6.54	±	0.43	±	0.35
0.24–0.30	0.265	97.7	6.63	±	0.40	±	0.27	0.265	113.4	5.25	±	0.34	±	0.28
0.30–0.36	0.324	97.2	5.36	±	0.38	±	0.27	0.325	113.5	2.20	±	0.21	±	0.16
0.36–0.42	0.387	96.6	2.69	±	0.27	±	0.18	0.380	112.3	1.38	±	0.18	±	0.14
0.42–0.50	0.453	96.4	1.47	±	0.15	±	0.13	0.444	111.2	0.91	±	0.14	±	0.12
0.50–0.60	0.529	96.6	0.95	±	0.13	±	0.12	0.526	111.0	0.25	±	0.05	±	0.04
0.60–0.72	0.643	97.4	0.20	±	0.05	±	0.03	0.623	115.0	0.04	±	0.03	±	0.02
0.72–0.90	0.762	94.4	0.11	±	0.03	±	0.02							

Table A.22 Double-differential inclusive cross-section $d^2\sigma/dp\,d\Omega$ [mb/(GeV/c sr)] of the production of protons in $\pi^+ + \mathrm{Be} \to \mathrm{p} + \mathrm{X}$ interactions with +12.0 GeV/c beam momentum; the first error is statistical, the second systematic; p_T in GeV/c, polar angle θ in degrees

p_T	$20 < \theta < 30$							$30 < \theta < 40$						
	$\langle p_\mathrm{T}\rangle$	$\langle\theta\rangle$	$d^2\sigma/dp\,d\Omega$					$\langle p_\mathrm{T}\rangle$	$\langle\theta\rangle$	$d^2\sigma/dp\,d\Omega$				
0.20–0.24	0.222	24.8	33.15	±	5.14	±	2.10							
0.24–0.30	0.269	24.9	26.85	±	3.64	±	1.49	0.271	34.9	33.55	±	4.04	±	1.83
0.30–0.36	0.329	24.6	35.59	±	4.18	±	1.77	0.330	34.9	34.02	±	4.00	±	1.65
0.36–0.42	0.386	25.0	29.52	±	3.74	±	1.33	0.390	35.3	34.04	±	4.12	±	1.44
0.42–0.50	0.459	25.0	24.09	±	2.90	±	0.96	0.459	35.4	23.40	±	2.93	±	0.96
0.50–0.60	0.544	25.5	25.01	±	2.66	±	0.99	0.541	35.0	23.64	±	2.72	±	0.93
0.60–0.72	0.649	24.4	16.32	±	1.87	±	0.74	0.658	34.8	14.30	±	1.84	±	0.68
0.72–0.90								0.794	34.6	9.70	±	1.25	±	0.61
p_T	$40 < \theta < 50$							$50 < \theta < 60$						
	$\langle p_\mathrm{T}\rangle$	$\langle\theta\rangle$	$d^2\sigma/dp\,d\Omega$					$\langle p_\mathrm{T}\rangle$	$\langle\theta\rangle$	$d^2\sigma/dp\,d\Omega$				
0.30–0.36	0.327	45.1	24.69	±	3.52	±	1.03							
0.36–0.42	0.393	45.2	27.74	±	3.71	±	1.10	0.387	55.8	20.10	±	3.07	±	0.88
0.42–0.50	0.456	45.1	23.65	±	2.96	±	0.93	0.458	55.1	18.02	±	2.54	±	0.74
0.50–0.60	0.545	45.0	17.32	±	2.30	±	0.72	0.550	55.2	13.05	±	1.96	±	0.63
0.60–0.72	0.657	44.7	10.89	±	1.66	±	0.56	0.663	54.5	9.40	±	1.58	±	0.54
0.72–0.90	0.805	44.8	9.28	±	1.26	±	0.62	0.786	54.3	5.25	±	0.98	±	0.39
0.90–1.25	1.024	43.7	2.02	±	0.41	±	0.21	1.010	54.7	2.14	±	0.45	±	0.25
p_T	$60 < \theta < 75$							$75 < \theta < 90$						
	$\langle p_\mathrm{T}\rangle$	$\langle\theta\rangle$	$d^2\sigma/dp\,d\Omega$					$\langle p_\mathrm{T}\rangle$	$\langle\theta\rangle$	$d^2\sigma/dp\,d\Omega$				
0.36–0.42	0.396	68.4	23.44	±	2.62	±	1.17							
0.42–0.50	0.462	66.9	21.70	±	2.25	±	0.86	0.464	81.7	12.36	±	1.67	±	0.64
0.50–0.60	0.554	66.9	12.09	±	1.55	±	0.56	0.561	81.1	8.45	±	1.30	±	0.50
0.60–0.72	0.665	67.3	8.91	±	1.28	±	0.58	0.652	81.7	3.95	±	0.83	±	0.33
0.72–0.90	0.830	66.7	3.92	±	0.70	±	0.37	0.825	81.7	2.91	±	0.62	±	0.32
0.90–1.25	1.063	67.2	0.90	±	0.24	±	0.13	1.031	80.7	0.58	±	0.20	±	0.10
p_T	$90 < \theta < 105$							$105 < \theta < 125$						
	$\langle p_\mathrm{T}\rangle$	$\langle\theta\rangle$	$d^2\sigma/dp\,d\Omega$					$\langle p_\mathrm{T}\rangle$	$\langle\theta\rangle$	$d^2\sigma/dp\,d\Omega$				
0.36–0.42								0.393	112.5	7.10	±	1.30	±	0.38
0.42–0.50	0.468	96.4	6.41	±	1.26	±	0.43	0.462	114.0	3.66	±	0.81	±	0.26
0.50–0.60	0.552	96.5	4.78	±	0.97	±	0.39	0.562	112.9	2.41	±	0.64	±	0.26
0.60–0.72	0.679	96.1	2.80	±	0.74	±	0.29	0.689	109.0	0.88	±	0.36	±	0.14
0.72–0.90	0.846	97.0	0.59	±	0.27	±	0.08	0.803	109.4	0.29	±	0.17	±	0.07
0.90–1.25	1.063	98.3	0.20	±	0.13	±	0.04							

Table A.23 Double-differential inclusive cross-section $d^2\sigma/dp\,d\Omega$ [mb/(GeV/c sr)] of the production of π^+'s in $\pi^+ + \mathrm{Be} \to \pi^+ + \mathrm{X}$ interactions with +12.0 GeV/c beam momentum; the first error is statistical, the second systematic; p_T in GeV/c, polar angle θ in degrees

p_T	$20 < \theta < 30$							$30 < \theta < 40$						
	$\langle p_\mathrm{T}\rangle$	$\langle\theta\rangle$	$d^2\sigma/dp\,d\Omega$					$\langle p_\mathrm{T}\rangle$	$\langle\theta\rangle$	$d^2\sigma/dp\,d\Omega$				
0.10–0.13	0.117	24.8	35.14	±	7.12	±	2.68	0.115	36.3	40.25	±	7.54	±	3.21
0.13–0.16	0.149	24.2	49.55	±	7.52	±	3.10	0.146	33.9	43.15	±	7.16	±	2.78
0.16–0.20	0.180	24.6	88.52	±	8.54	±	4.63	0.182	34.7	61.79	±	7.47	±	3.49
0.20–0.24	0.221	24.9	76.40	±	8.04	±	3.55	0.220	35.4	66.66	±	7.43	±	3.15
0.24–0.30	0.268	24.2	93.08	±	7.11	±	3.59	0.268	34.8	60.65	±	5.76	±	2.36
0.30–0.36	0.328	24.9	65.62	±	5.87	±	2.21	0.327	34.4	51.40	±	5.12	±	1.83
0.36–0.42	0.387	24.2	62.31	±	5.59	±	2.10	0.383	34.5	38.13	±	4.49	±	1.37
0.42–0.50	0.456	24.5	45.10	±	4.14	±	1.78	0.455	34.2	21.54	±	2.80	±	0.85
0.50–0.60	0.541	24.8	31.91	±	3.08	±	1.72	0.540	34.6	19.08	±	2.42	±	1.00
0.60–0.72	0.651	24.5	21.60	±	2.28	±	1.79	0.645	34.9	14.67	±	1.84	±	1.10
0.72–0.90								0.793	34.4	5.69	±	0.84	±	0.66
p_T	$40 < \theta < 50$							$50 < \theta < 60$						
	$\langle p_\mathrm{T}\rangle$	$\langle\theta\rangle$	$d^2\sigma/dp\,d\Omega$					$\langle p_\mathrm{T}\rangle$	$\langle\theta\rangle$	$d^2\sigma/dp\,d\Omega$				
0.10–0.13	0.114	44.7	21.46	±	5.40	±	1.80							
0.13–0.16	0.144	44.7	40.74	±	6.75	±	2.81	0.145	55.9	17.62	±	4.41	±	1.37
0.16–0.20	0.181	45.8	35.78	±	5.57	±	2.06	0.178	54.4	19.83	±	4.15	±	1.20
0.20–0.24	0.218	45.0	37.42	±	5.36	±	1.91	0.221	55.0	29.93	±	5.04	±	1.61
0.24–0.30	0.268	44.5	29.80	±	3.99	±	1.24	0.268	54.2	24.21	±	3.56	±	1.06
0.30–0.36	0.326	44.8	28.71	±	3.82	±	1.11	0.326	54.7	17.58	±	3.06	±	0.74
0.36–0.42	0.394	44.7	30.87	±	4.08	±	1.24	0.391	54.6	14.56	±	2.70	±	0.66
0.42–0.50	0.455	44.1	22.43	±	2.98	±	0.99	0.456	54.7	11.25	±	2.00	±	0.59
0.50–0.60	0.551	44.8	9.91	±	1.69	±	0.56	0.545	53.9	11.76	±	1.94	±	0.71
0.60–0.72	0.657	44.9	10.69	±	1.64	±	0.78	0.645	54.9	3.72	±	0.91	±	0.31
0.72–0.90	0.791	44.1	5.08	±	0.87	±	0.56	0.795	54.5	1.95	±	0.52	±	0.22
0.90–1.25								1.080	54.3	0.35	±	0.14	±	0.07
p_T	$60 < \theta < 75$							$75 < \theta < 90$						
	$\langle p_\mathrm{T}\rangle$	$\langle\theta\rangle$	$d^2\sigma/dp\,d\Omega$					$\langle p_\mathrm{T}\rangle$	$\langle\theta\rangle$	$d^2\sigma/dp\,d\Omega$				
0.13–0.16	0.144	67.9	15.72	±	3.32	±	1.26	0.144	81.0	10.28	±	2.58	±	0.93
0.16–0.20	0.181	66.7	21.22	±	3.35	±	1.26	0.182	83.3	15.35	±	2.88	±	0.94
0.20–0.24	0.218	67.5	19.17	±	3.19	±	0.99	0.219	83.8	9.02	±	2.07	±	0.55
0.24–0.30	0.273	67.5	16.16	±	2.36	±	0.70	0.268	82.6	7.90	±	1.59	±	0.39
0.30–0.36	0.329	67.9	10.81	±	1.99	±	0.46	0.328	81.7	9.06	±	1.77	±	0.46
0.36–0.42	0.394	66.0	11.42	±	1.95	±	0.55	0.389	83.7	6.21	±	1.46	±	0.38
0.42–0.50	0.467	66.4	5.86	±	1.17	±	0.33	0.469	81.6	4.74	±	1.08	±	0.35
0.50–0.60	0.548	67.5	5.42	±	1.02	±	0.39	0.556	81.8	2.88	±	0.76	±	0.28
0.60–0.72	0.672	67.1	2.62	±	0.68	±	0.25	0.664	81.2	0.97	±	0.41	±	0.12
0.72–0.90	0.820	65.6	1.13	±	0.32	±	0.16	0.872	81.4	0.40	±	0.18	±	0.08
0.90–1.25	1.069	65.8	0.09	±	0.06	±	0.02							

Table A.23 (*Continued*)

p_T	$90 < \theta < 105$							$105 < \theta < 125$						
	$\langle p_T \rangle$	$\langle \theta \rangle$	$d^2\sigma/dp\,d\Omega$					$\langle p_T \rangle$	$\langle \theta \rangle$	$d^2\sigma/dp\,d\Omega$				
0.13–0.16	0.146	96.5	12.51	±	2.88	±	1.07	0.143	114.9	9.25	±	2.12	±	0.76
0.16–0.20	0.179	96.9	10.03	±	2.17	±	0.74	0.177	116.0	9.61	±	1.84	±	0.62
0.20–0.24	0.218	96.1	10.93	±	2.32	±	0.70	0.221	112.4	4.74	±	1.43	±	0.31
0.24–0.30	0.268	96.6	9.37	±	1.88	±	0.53	0.265	113.9	3.88	±	1.00	±	0.27
0.30–0.36	0.329	97.1	3.40	±	1.08	±	0.23	0.319	113.5	2.03	±	0.72	±	0.18
0.36–0.42	0.398	98.5	2.04	±	0.83	±	0.18	0.391	113.8	1.59	±	0.58	±	0.20
0.42–0.50	0.475	96.8	1.64	±	0.67	±	0.18	0.472	110.7	0.37	±	0.26	±	0.05
0.50–0.60	0.542	95.5	1.48	±	0.52	±	0.21							
0.60–0.72								0.675	112.8	0.52	±	0.26	±	0.12
0.72–0.90	0.766	93.0	0.22	±	0.16	±	0.06							

Table A.24 Double-differential inclusive cross-section $d^2\sigma/dp\,d\Omega$ [mb/(GeV/c sr)] of the production of π^-'s in $\pi^+ + \mathrm{Be} \to \pi^- + \mathrm{X}$ interactions with +12.0 GeV/c beam momentum; the first error is statistical, the second systematic; p_T in GeV/c, polar angle θ in degrees

p_T	$20 < \theta < 30$							$30 < \theta < 40$						
	$\langle p_T \rangle$	$\langle \theta \rangle$	$d^2\sigma/dp\,d\Omega$					$\langle p_T \rangle$	$\langle \theta \rangle$	$d^2\sigma/dp\,d\Omega$				
0.10–0.13	0.116	24.6	57.74	±	8.98	±	4.49	0.114	34.7	30.36	±	5.92	±	2.47
0.13–0.16	0.145	24.9	65.62	±	9.02	±	4.41	0.147	35.3	48.43	±	7.48	±	3.26
0.16–0.20	0.183	24.6	64.93	±	7.34	±	3.50	0.184	34.6	38.24	±	5.44	±	2.19
0.20–0.24	0.221	24.7	63.89	±	7.29	±	3.00	0.220	34.9	60.38	±	6.97	±	2.98
0.24–0.30	0.271	25.1	67.36	±	5.97	±	2.52	0.271	34.8	44.52	±	4.82	±	1.78
0.30–0.36	0.330	24.3	54.35	±	5.29	±	1.85	0.331	35.2	34.54	±	4.30	±	1.27
0.36–0.42	0.389	24.2	40.93	±	4.61	±	1.47	0.391	34.8	27.82	±	3.80	±	1.09
0.42–0.50	0.456	24.8	31.08	±	3.50	±	1.31	0.462	35.4	15.87	±	2.38	±	0.74
0.50–0.60	0.547	24.6	21.39	±	2.62	±	1.20	0.554	35.2	13.59	±	2.12	±	0.79
0.60–0.72	0.653	24.4	10.69	±	1.65	±	0.83	0.660	35.0	6.45	±	1.20	±	0.54
0.72–0.90								0.800	36.2	2.58	±	0.65	±	0.29
p_T	$40 < \theta < 50$							$50 < \theta < 60$						
	$\langle p_T \rangle$	$\langle \theta \rangle$	$d^2\sigma/dp\,d\Omega$					$\langle p_T \rangle$	$\langle \theta \rangle$	$d^2\sigma/dp\,d\Omega$				
0.10–0.13	0.117	45.5	18.69	±	4.70	±	1.78							
0.13–0.16	0.144	44.1	32.03	±	5.60	±	2.46	0.146	55.4	33.93	±	6.29	±	2.58
0.16–0.20	0.178	44.3	40.68	±	5.98	±	2.54	0.180	54.9	20.99	±	4.06	±	1.33
0.20–0.24	0.220	44.5	29.01	±	4.59	±	1.58	0.218	54.8	24.86	±	4.42	±	1.41
0.24–0.30	0.271	44.9	34.47	±	4.28	±	1.49	0.267	54.1	15.61	±	2.86	±	0.73
0.30–0.36	0.332	45.5	20.65	±	3.19	±	0.85	0.333	53.9	12.89	±	2.40	±	0.69
0.36–0.42	0.386	44.9	20.49	±	3.25	±	0.90	0.387	55.2	12.65	±	2.53	±	0.66
0.42–0.50	0.455	44.0	9.87	±	1.79	±	0.56	0.454	53.9	7.58	±	1.62	±	0.47
0.50–0.60	0.548	44.8	7.65	±	1.42	±	0.55	0.540	55.1	4.94	±	1.24	±	0.35
0.60–0.72	0.649	44.0	5.49	±	1.17	±	0.49	0.642	53.2	2.85	±	0.79	±	0.28
0.72–0.90	0.811	43.7	1.48	±	0.47	±	0.18	0.775	55.4	1.85	±	0.53	±	0.24

Table A.24 (*Continued*)

p_T	$60 < \theta < 75$							$75 < \theta < 90$						
	$\langle p_T \rangle$	$\langle \theta \rangle$	$d^2\sigma/dp\,d\Omega$					$\langle p_T \rangle$	$\langle \theta \rangle$	$d^2\sigma/dp\,d\Omega$				
0.13–0.16	0.146	66.3	11.91	±	2.79	±	1.00	0.144	83.5	12.66	±	2.89	±	1.02
0.16–0.20	0.175	66.3	16.88	±	2.84	±	1.09	0.177	83.2	14.35	±	2.63	±	1.01
0.20–0.24	0.216	68.0	13.44	±	2.60	±	0.75	0.214	83.0	11.01	±	2.30	±	0.72
0.24–0.30	0.266	66.8	8.88	±	1.68	±	0.43	0.261	81.9	10.46	±	1.88	±	0.55
0.30–0.36	0.323	67.3	11.35	±	1.95	±	0.55	0.328	82.3	4.73	±	1.22	±	0.31
0.36–0.42	0.377	64.5	7.16	±	1.47	±	0.44	0.385	81.0	4.66	±	1.25	±	0.35
0.42–0.50	0.456	65.8	5.81	±	1.10	±	0.44	0.448	81.3	4.22	±	1.00	±	0.38
0.50–0.60	0.535	66.1	3.97	±	0.89	±	0.32	0.534	81.3	2.47	±	0.68	±	0.30
0.60–0.72	0.629	67.1	1.17	±	0.41	±	0.13	0.647	81.0	1.00	±	0.41	±	0.15
0.72–0.90	0.811	65.2	0.85	±	0.30	±	0.12	0.773	88.4	0.21	±	0.15	±	0.05
p_T	$90 < \theta < 105$							$105 < \theta < 125$						
	$\langle p_T \rangle$	$\langle \theta \rangle$	$d^2\sigma/dp\,d\Omega$					$\langle p_T \rangle$	$\langle \theta \rangle$	$d^2\sigma/dp\,d\Omega$				
0.13–0.16	0.145	94.3	9.09	±	2.43	±	0.84	0.144	116.4	9.99	±	2.08	±	0.95
0.16–0.20	0.180	97.5	8.41	±	1.84	±	0.75	0.178	113.4	8.07	±	1.51	±	0.78
0.20–0.24	0.221	96.1	7.81	±	1.85	±	0.61	0.216	111.1	3.20	±	1.01	±	0.29
0.24–0.30	0.261	96.8	4.65	±	1.13	±	0.39	0.261	114.1	2.86	±	0.83	±	0.24
0.30–0.36	0.325	96.2	5.81	±	1.33	±	0.52	0.340	113.0	1.37	±	0.56	±	0.14
0.36–0.42	0.377	97.0	3.11	±	0.94	±	0.37	0.380	111.3	1.27	±	0.57	±	0.16
0.42–0.50	0.453	94.7	1.49	±	0.53	±	0.23	0.444	118.4	1.36	±	0.56	±	0.21
0.50–0.60	0.524	96.4	0.60	±	0.35	±	0.11	0.509	112.6	0.24	±	0.17	±	0.05
0.60–0.72	0.634	101.7	0.55	±	0.27	±	0.15							

Table A.25 Double-differential inclusive cross-section $d^2\sigma/dp\,d\Omega$ [mb/(GeV/c sr)] of the production of protons in $\pi^- + \mathrm{Be} \to \mathrm{p} + \mathrm{X}$ interactions with -12.0 GeV/c beam momentum; the first error is statistical, the second systematic; p_T in GeV/c, polar angle θ in degrees

p_T	$20 < \theta < 30$							$30 < \theta < 40$						
	$\langle p_\mathrm{T}\rangle$	$\langle\theta\rangle$	$d^2\sigma/dp\,d\Omega$					$\langle p_\mathrm{T}\rangle$	$\langle\theta\rangle$	$d^2\sigma/dp\,d\Omega$				
0.20–0.24	0.219	24.7	24.37	±	1.24	±	1.58							
0.24–0.30	0.270	25.2	27.58	±	1.06	±	1.57	0.270	35.1	26.28	±	1.03	±	1.44
0.30–0.36	0.330	24.9	25.60	±	1.02	±	1.26	0.329	34.8	24.47	±	0.98	±	1.19
0.36–0.42	0.390	25.1	23.23	±	0.95	±	1.07	0.389	34.8	21.37	±	0.93	±	0.96
0.42–0.50	0.460	24.9	20.04	±	0.76	±	0.81	0.459	35.1	19.61	±	0.78	±	0.79
0.50–0.60	0.548	24.9	17.86	±	0.64	±	0.71	0.549	34.8	15.55	±	0.61	±	0.64
0.60–0.72	0.656	25.0	14.16	±	0.51	±	0.66	0.654	34.7	11.53	±	0.48	±	0.56
0.72–0.90								0.802	34.8	7.41	±	0.32	±	0.47
p_T	$40 < \theta < 50$							$50 < \theta < 60$						
	$\langle p_\mathrm{T}\rangle$	$\langle\theta\rangle$	$d^2\sigma/dp\,d\Omega$					$\langle p_\mathrm{T}\rangle$	$\langle\theta\rangle$	$d^2\sigma/dp\,d\Omega$				
0.30–0.36	0.329	44.9	25.24	±	0.99	±	1.27							
0.36–0.42	0.389	44.9	20.63	±	0.89	±	0.97	0.391	54.9	21.24	±	0.89	±	0.95
0.42–0.50	0.460	44.9	17.35	±	0.72	±	0.67	0.458	55.0	16.67	±	0.71	±	0.72
0.50–0.60	0.548	44.9	14.17	±	0.60	±	0.60	0.546	54.8	12.02	±	0.55	±	0.56
0.60–0.72	0.657	44.8	9.43	±	0.44	±	0.48	0.656	54.9	7.89	±	0.42	±	0.44
0.72–0.90	0.798	44.9	6.12	±	0.31	±	0.41	0.794	54.7	4.43	±	0.26	±	0.33
0.90–1.25	1.035	44.9	1.84	±	0.12	±	0.19	1.028	55.1	1.14	±	0.09	±	0.14
p_T	$60 < \theta < 75$							$75 < \theta < 90$						
	$\langle p_\mathrm{T}\rangle$	$\langle\theta\rangle$	$d^2\sigma/dp\,d\Omega$					$\langle p_\mathrm{T}\rangle$	$\langle\theta\rangle$	$d^2\sigma/dp\,d\Omega$				
0.36–0.42	0.390	67.3	17.90	±	0.65	±	0.85							
0.42–0.50	0.459	67.4	14.10	±	0.51	±	0.56	0.459	82.1	11.64	±	0.47	±	0.55
0.50–0.60	0.549	67.3	10.83	±	0.42	±	0.50	0.545	82.0	7.52	±	0.35	±	0.47
0.60–0.72	0.658	67.3	6.07	±	0.30	±	0.40	0.650	81.8	4.11	±	0.25	±	0.35
0.72–0.90	0.795	66.7	3.21	±	0.18	±	0.30	0.794	81.7	1.65	±	0.13	±	0.19
0.90–1.25	1.033	66.7	0.76	±	0.07	±	0.12	1.041	81.1	0.43	±	0.05	±	0.07
p_T	$90 < \theta < 105$							$105 < \theta < 125$						
	$\langle p_\mathrm{T}\rangle$	$\langle\theta\rangle$	$d^2\sigma/dp\,d\Omega$					$\langle p_\mathrm{T}\rangle$	$\langle\theta\rangle$	$d^2\sigma/dp\,d\Omega$				
0.36–0.42								0.389	114.0	5.02	±	0.31	±	0.28
0.42–0.50	0.457	96.5	6.38	±	0.35	±	0.43	0.454	113.8	3.29	±	0.22	±	0.24
0.50–0.60	0.547	97.0	3.60	±	0.24	±	0.29	0.546	113.1	1.58	±	0.15	±	0.17
0.60–0.72	0.655	96.8	1.95	±	0.18	±	0.21	0.650	114.3	0.77	±	0.10	±	0.13
0.72–0.90	0.788	96.4	0.65	±	0.08	±	0.09	0.786	111.7	0.15	±	0.04	±	0.04
0.90–1.25	1.040	95.5	0.17	±	0.03	±	0.03	1.011	111.4	0.07	±	0.02	±	0.04

Table A.26 Double-differential inclusive cross-section $d^2\sigma/dp\,d\Omega$ [mb/(GeV/c sr)] of the production of π^+'s in $\pi^- + \mathrm{Be} \to \pi^+ + \mathrm{X}$ interactions with -12.0 GeV/c beam momentum; the first error is statistical, the second systematic; p_T in GeV/c, polar angle θ in degrees

p_T	$20 < \theta < 30$							$30 < \theta < 40$						
	$\langle p_\mathrm{T}\rangle$	$\langle\theta\rangle$	$d^2\sigma/dp\,d\Omega$					$\langle p_\mathrm{T}\rangle$	$\langle\theta\rangle$	$d^2\sigma/dp\,d\Omega$				
0.10–0.13	0.115	24.7	37.81	±	2.11	±	3.18	0.116	34.8	27.36	±	1.72	±	2.38
0.13–0.16	0.147	24.5	56.39	±	2.36	±	3.53	0.145	34.8	36.32	±	1.89	±	2.46
0.16–0.20	0.181	24.3	60.11	±	2.04	±	3.17	0.180	34.7	37.98	±	1.59	±	2.07
0.20–0.24	0.220	24.6	66.01	±	2.09	±	3.01	0.220	34.7	45.76	±	1.75	±	2.22
0.24–0.30	0.270	24.6	60.22	±	1.60	±	2.30	0.270	34.8	38.20	±	1.27	±	1.50
0.30–0.36	0.329	24.4	55.53	±	1.53	±	1.89	0.329	34.6	37.06	±	1.26	±	1.32
0.36–0.42	0.389	24.5	42.58	±	1.34	±	1.48	0.388	34.7	29.05	±	1.12	±	1.05
0.42–0.50	0.458	24.7	33.59	±	1.01	±	1.34	0.457	34.5	20.29	±	0.78	±	0.82
0.50–0.60	0.547	24.5	19.53	±	0.67	±	1.08	0.546	34.5	13.46	±	0.55	±	0.72
0.60–0.72	0.655	24.6	12.66	±	0.48	±	1.03	0.655	34.6	7.63	±	0.37	±	0.59
0.72–0.90								0.799	34.5	3.21	±	0.17	±	0.40
p_T	$40 < \theta < 50$							$50 < \theta < 60$						
	$\langle p_\mathrm{T}\rangle$	$\langle\theta\rangle$	$d^2\sigma/dp\,d\Omega$					$\langle p_\mathrm{T}\rangle$	$\langle\theta\rangle$	$d^2\sigma/dp\,d\Omega$				
0.10–0.13	0.115	44.8	20.24	±	1.52	±	1.83							
0.13–0.16	0.145	44.8	22.63	±	1.47	±	1.59	0.146	55.2	18.96	±	1.36	±	1.44
0.16–0.20	0.180	44.9	27.72	±	1.37	±	1.61	0.180	54.8	20.77	±	1.17	±	1.23
0.20–0.24	0.220	44.9	27.68	±	1.34	±	1.41	0.219	54.8	17.76	±	1.08	±	0.94
0.24–0.30	0.270	44.8	28.76	±	1.13	±	1.19	0.270	54.4	18.53	±	0.88	±	0.81
0.30–0.36	0.330	44.6	22.58	±	0.96	±	0.87	0.330	54.7	14.68	±	0.78	±	0.60
0.36–0.42	0.388	44.6	18.41	±	0.86	±	0.80	0.391	54.5	10.85	±	0.65	±	0.53
0.42–0.50	0.458	44.5	13.56	±	0.65	±	0.60	0.458	54.4	8.72	±	0.49	±	0.44
0.50–0.60	0.545	44.8	7.94	±	0.41	±	0.54	0.547	54.5	6.43	±	0.39	±	0.40
0.60–0.72	0.650	44.1	4.72	±	0.29	±	0.39	0.650	54.4	3.19	±	0.25	±	0.28
0.72–0.90	0.790	43.9	2.51	±	0.18	±	0.28	0.792	54.7	1.55	±	0.13	±	0.18
0.90–1.25								1.020	55.1	0.29	±	0.03	±	0.06
p_T	$60 < \theta < 75$							$75 < \theta < 90$						
	$\langle p_\mathrm{T}\rangle$	$\langle\theta\rangle$	$d^2\sigma/dp\,d\Omega$					$\langle p_\mathrm{T}\rangle$	$\langle\theta\rangle$	$d^2\sigma/dp\,d\Omega$				
0.13–0.16	0.146	66.6	15.03	±	0.96	±	1.15	0.146	81.6	10.31	±	0.78	±	0.83
0.16–0.20	0.180	67.0	15.09	±	0.79	±	0.90	0.180	82.5	11.99	±	0.70	±	0.79
0.20–0.24	0.220	67.3	14.63	±	0.78	±	0.75	0.218	81.8	9.59	±	0.63	±	0.56
0.24–0.30	0.269	66.7	12.15	±	0.57	±	0.56	0.271	81.3	7.54	±	0.45	±	0.38
0.30–0.36	0.329	66.9	9.86	±	0.52	±	0.42	0.327	81.7	5.51	±	0.38	±	0.29
0.36–0.42	0.389	67.3	7.28	±	0.43	±	0.39	0.387	82.1	4.04	±	0.31	±	0.30
0.42–0.50	0.456	66.9	5.77	±	0.33	±	0.36	0.456	81.1	3.10	±	0.26	±	0.22
0.50–0.60	0.548	67.1	3.53	±	0.23	±	0.27	0.544	81.6	1.74	±	0.16	±	0.17
0.60–0.72	0.656	66.2	1.91	±	0.15	±	0.20	0.647	81.5	0.89	±	0.10	±	0.12
0.72–0.90	0.787	66.3	0.59	±	0.06	±	0.09	0.776	80.3	0.22	±	0.04	±	0.04
0.90–1.25	1.016	66.1	0.09	±	0.02	±	0.02	1.021	80.9	0.06	±	0.02	±	0.02

Table A.26 (*Continued*)

p_T	$90 < \theta < 105$							$105 < \theta < 125$						
	$\langle p_T \rangle$	$\langle \theta \rangle$	$d^2\sigma/dp\,d\Omega$					$\langle p_T \rangle$	$\langle \theta \rangle$	$d^2\sigma/dp\,d\Omega$				
0.13–0.16	0.147	97.3	8.37	±	0.68	±	0.74	0.145	114.2	6.89	±	0.51	±	0.63
0.16–0.20	0.179	96.9	9.48	±	0.59	±	0.76	0.179	114.2	6.06	±	0.39	±	0.49
0.20–0.24	0.221	97.2	6.57	±	0.48	±	0.55	0.218	113.7	4.46	±	0.35	±	0.32
0.24–0.30	0.267	97.0	5.42	±	0.38	±	0.31	0.268	113.0	3.28	±	0.25	±	0.22
0.30–0.36	0.329	97.6	3.18	±	0.28	±	0.21	0.329	112.8	1.69	±	0.18	±	0.17
0.36–0.42	0.386	96.8	2.11	±	0.22	±	0.20	0.387	113.5	1.20	±	0.16	±	0.15
0.42–0.50	0.458	96.8	1.48	±	0.17	±	0.18	0.458	111.9	0.45	±	0.08	±	0.07
0.50–0.60	0.544	95.3	0.92	±	0.12	±	0.14	0.541	111.5	0.27	±	0.06	±	0.06
0.60–0.72	0.645	95.3	0.38	±	0.07	±	0.08	0.660	110.2	0.10	±	0.03	±	0.04
0.72–0.90	0.784	97.0	0.11	±	0.03	±	0.03							

Table A.27 Double-differential inclusive cross-section $d^2\sigma/dp\,d\Omega$ [mb/(GeV/c sr)] of the production of π^-'s in $\pi^- + \mathrm{Be} \to \pi^- + \mathrm{X}$ interactions with -12.0 GeV/c beam momentum; the first error is statistical, the second systematic; p_T in GeV/c, polar angle θ in degrees

p_T	$20 < \theta < 30$							$30 < \theta < 40$						
	$\langle p_T \rangle$	$\langle \theta \rangle$	$d^2\sigma/dp\,d\Omega$					$\langle p_T \rangle$	$\langle \theta \rangle$	$d^2\sigma/dp\,d\Omega$				
0.10–0.13	0.115	24.7	61.40	±	2.64	±	4.67	0.116	34.9	37.58	±	2.00	±	3.13
0.13–0.16	0.146	24.6	74.65	±	2.71	±	4.59	0.145	34.8	51.55	±	2.24	±	3.35
0.16–0.20	0.181	24.6	89.44	±	2.50	±	4.58	0.179	34.6	56.00	±	1.94	±	2.98
0.20–0.24	0.220	24.7	93.92	±	2.50	±	4.10	0.220	34.8	55.62	±	1.92	±	2.54
0.24–0.30	0.269	24.7	89.26	±	1.99	±	3.18	0.270	34.5	56.17	±	1.57	±	2.08
0.30–0.36	0.329	24.6	80.56	±	1.90	±	2.52	0.329	34.4	48.82	±	1.45	±	1.61
0.36–0.42	0.389	24.8	61.66	±	1.66	±	1.99	0.388	34.7	40.31	±	1.31	±	1.37
0.42–0.50	0.457	24.6	49.30	±	1.28	±	1.96	0.457	34.6	31.63	±	1.01	±	1.25
0.50–0.60	0.546	24.6	35.99	±	0.98	±	1.90	0.545	34.7	19.87	±	0.71	±	1.05
0.60–0.72	0.654	24.7	20.76	±	0.67	±	1.53	0.655	34.9	12.42	±	0.52	±	0.90
0.72–0.90								0.798	34.5	6.06	±	0.29	±	0.62
p_T	$40 < \theta < 50$							$50 < \theta < 60$						
	$\langle p_T \rangle$	$\langle \theta \rangle$	$d^2\sigma/dp\,d\Omega$					$\langle p_T \rangle$	$\langle \theta \rangle$	$d^2\sigma/dp\,d\Omega$				
0.10–0.13	0.115	44.6	26.91	±	1.66	±	2.31							
0.13–0.16	0.146	44.9	32.36	±	1.73	±	2.29	0.146	54.9	26.40	±	1.53	±	1.92
0.16–0.20	0.181	45.0	39.25	±	1.64	±	2.18	0.180	54.8	28.89	±	1.38	±	1.71
0.20–0.24	0.220	44.9	40.39	±	1.62	±	1.94	0.220	54.9	34.31	±	1.52	±	1.68
0.24–0.30	0.269	44.6	35.17	±	1.22	±	1.36	0.269	54.9	25.48	±	1.05	±	1.01
0.30–0.36	0.329	44.7	30.35	±	1.14	±	1.07	0.330	54.6	22.27	±	0.95	±	0.88
0.36–0.42	0.389	44.9	25.10	±	1.01	±	1.00	0.389	54.4	18.13	±	0.85	±	0.84
0.42–0.50	0.458	44.7	19.57	±	0.79	±	0.86	0.458	54.8	12.33	±	0.62	±	0.60
0.50–0.60	0.548	44.6	12.89	±	0.57	±	0.77	0.545	54.7	8.63	±	0.46	±	0.56
0.60–0.72	0.655	44.7	7.61	±	0.40	±	0.60	0.650	55.0	5.04	±	0.32	±	0.42
0.72–0.90	0.796	44.8	4.16	±	0.25	±	0.46	0.796	54.7	2.06	±	0.17	±	0.24
0.90–1.25								1.035	54.9	0.27	±	0.03	±	0.06

Table A.27 (*Continued*)

p_T	$60 < \theta < 75$							$75 < \theta < 90$						
	$\langle p_T \rangle$	$\langle \theta \rangle$	$d^2\sigma/dp\,d\Omega$					$\langle p_T \rangle$	$\langle \theta \rangle$	$d^2\sigma/dp\,d\Omega$				
0.13–0.16	0.145	67.0	20.47	±	1.10	±	1.50	0.145	82.7	14.90	±	0.88	±	1.39
0.16–0.20	0.180	66.9	22.46	±	0.96	±	1.30	0.180	82.0	17.77	±	0.85	±	1.09
0.20–0.24	0.219	67.2	22.17	±	0.98	±	1.01	0.219	82.4	16.30	±	0.82	±	0.83
0.24–0.30	0.269	67.2	18.12	±	0.70	±	0.70	0.269	81.8	11.77	±	0.57	±	0.49
0.30–0.36	0.329	66.8	15.01	±	0.66	±	0.57	0.330	82.0	8.08	±	0.47	±	0.38
0.36–0.42	0.388	66.8	10.98	±	0.54	±	0.51	0.390	82.0	6.17	±	0.41	±	0.37
0.42–0.50	0.458	66.5	8.19	±	0.40	±	0.43	0.458	82.0	5.03	±	0.33	±	0.35
0.50–0.60	0.544	66.5	5.11	±	0.29	±	0.36	0.544	81.2	2.28	±	0.19	±	0.22
0.60–0.72	0.656	66.5	2.65	±	0.19	±	0.25	0.654	81.9	1.13	±	0.12	±	0.14
0.72–0.90	0.794	66.4	1.09	±	0.10	±	0.16	0.792	80.8	0.37	±	0.05	±	0.07
0.90–1.25	1.008	66.1	0.14	±	0.02	±	0.03	0.994	82.7	0.03	±	0.02	±	0.01
p_T	$90 < \theta < 105$							$105 < \theta < 125$						
	$\langle p_T \rangle$	$\langle \theta \rangle$	$d^2\sigma/dp\,d\Omega$					$\langle p_T \rangle$	$\langle \theta \rangle$	$d^2\sigma/dp\,d\Omega$				
0.13–0.16	0.144	97.5	14.53	±	0.88	±	1.45	0.145	114.6	11.01	±	0.64	±	0.85
0.16–0.20	0.180	97.0	13.24	±	0.70	±	0.89	0.178	114.6	10.36	±	0.54	±	0.71
0.20–0.24	0.219	96.3	12.73	±	0.70	±	0.72	0.219	114.3	7.09	±	0.46	±	0.43
0.24–0.30	0.268	96.9	7.41	±	0.46	±	0.36	0.266	113.9	5.35	±	0.33	±	0.32
0.30–0.36	0.329	96.7	6.16	±	0.41	±	0.38	0.329	113.2	2.96	±	0.24	±	0.26
0.36–0.42	0.387	97.3	4.18	±	0.33	±	0.35	0.385	112.0	1.76	±	0.19	±	0.21
0.42–0.50	0.457	97.0	2.70	±	0.23	±	0.26	0.458	112.4	0.92	±	0.12	±	0.14
0.50–0.60	0.545	96.1	1.22	±	0.14	±	0.17	0.554	111.6	0.23	±	0.05	±	0.04
0.60–0.72	0.662	97.0	0.44	±	0.08	±	0.08	0.633	109.6	0.09	±	0.03	±	0.02
0.72–0.90	0.769	96.3	0.08	±	0.02	±	0.02							

Table A.28 Double-differential inclusive cross-section $d^2\sigma/dp\,d\Omega$ [mb/(GeV/c sr)] of the production of protons in p + Be → p + X interactions with +15.0 GeV/c beam momentum; the first error is statistical, the second systematic; p_T in GeV/c, polar angle θ in degrees

p_T	$20 < \theta < 30$							$30 < \theta < 40$						
	$\langle p_T \rangle$	$\langle \theta \rangle$	$d^2\sigma/dp\,d\Omega$					$\langle p_T \rangle$	$\langle \theta \rangle$	$d^2\sigma/dp\,d\Omega$				
0.20–0.24	0.220	25.0	38.48	±	1.80	±	2.13							
0.24–0.30	0.269	24.8	45.17	±	1.57	±	2.24	0.270	34.9	41.34	±	1.48	±	1.96
0.30–0.36	0.329	24.9	42.76	±	1.52	±	1.89	0.329	34.7	40.33	±	1.47	±	1.63
0.36–0.42	0.388	24.9	38.44	±	1.41	±	1.45	0.387	34.8	36.60	±	1.43	±	1.40
0.42–0.50	0.458	24.8	35.42	±	1.17	±	1.17	0.456	34.9	29.87	±	1.10	±	0.96
0.50–0.60	0.545	24.8	30.77	±	0.97	±	1.01	0.544	34.9	27.28	±	0.95	±	0.86
0.60–0.72	0.651	24.9	23.67	±	0.77	±	0.94	0.652	34.9	20.16	±	0.74	±	0.80
0.72–0.90								0.796	34.6	13.08	±	0.49	±	0.77
p_T	$40 < \theta < 50$							$50 < \theta < 60$						
	$\langle p_T \rangle$	$\langle \theta \rangle$	$d^2\sigma/dp\,d\Omega$					$\langle p_T \rangle$	$\langle \theta \rangle$	$d^2\sigma/dp\,d\Omega$				
0.30–0.36	0.329	44.9	35.19	±	1.34	±	1.31							
0.36–0.42	0.389	44.8	35.39	±	1.38	±	1.18	0.390	54.9	30.73	±	1.25	±	1.00
0.42–0.50	0.459	45.1	27.81	±	1.06	±	0.84	0.458	55.0	27.63	±	1.05	±	0.90
0.50–0.60	0.549	45.0	24.39	±	0.93	±	0.80	0.548	55.1	19.33	±	0.82	±	0.75
0.60–0.72	0.656	44.9	15.07	±	0.65	±	0.67	0.656	55.0	13.96	±	0.64	±	0.68
0.72–0.90	0.801	44.7	9.83	±	0.44	±	0.59	0.798	54.8	7.93	±	0.40	±	0.53
0.90–1.25	1.042	44.7	3.58	±	0.19	±	0.35	1.033	54.5	2.36	±	0.16	±	0.25
p_T	$60 < \theta < 75$							$75 < \theta < 90$						
	$\langle p_T \rangle$	$\langle \theta \rangle$	$d^2\sigma/dp\,d\Omega$					$\langle p_T \rangle$	$\langle \theta \rangle$	$d^2\sigma/dp\,d\Omega$				
0.36–0.42	0.391	67.4	30.19	±	1.01	±	1.17							
0.42–0.50	0.459	67.5	22.43	±	0.74	±	0.70	0.456	81.8	18.38	±	0.68	±	0.74
0.50–0.60	0.547	67.2	17.44	±	0.64	±	0.72	0.546	81.5	11.95	±	0.51	±	0.64
0.60–0.72	0.656	67.2	9.77	±	0.44	±	0.59	0.653	82.0	5.69	±	0.35	±	0.46
0.72–0.90	0.796	66.4	5.08	±	0.27	±	0.45	0.790	81.6	1.84	±	0.16	±	0.20
0.90–1.25	1.027	66.5	1.30	±	0.10	±	0.19	1.047	80.8	0.51	±	0.07	±	0.08
p_T	$90 < \theta < 105$							$105 < \theta < 125$						
	$\langle p_T \rangle$	$\langle \theta \rangle$	$d^2\sigma/dp\,d\Omega$					$\langle p_T \rangle$	$\langle \theta \rangle$	$d^2\sigma/dp\,d\Omega$				
0.36–0.42								0.389	113.1	6.78	±	0.41	±	0.27
0.42–0.50	0.457	96.6	11.28	±	0.55	±	0.66	0.457	112.4	5.32	±	0.33	±	0.29
0.50–0.60	0.545	96.7	6.14	±	0.38	±	0.44	0.544	112.6	2.08	±	0.20	±	0.20
0.60–0.72	0.650	96.3	2.59	±	0.25	±	0.26	0.651	111.1	0.74	±	0.11	±	0.11
0.72–0.90	0.786	96.2	1.08	±	0.12	±	0.13	0.768	110.6	0.36	±	0.07	±	0.08
0.90–1.25	1.028	97.3	0.23	±	0.05	±	0.04	1.000	115.3	0.03	±	0.02	±	0.02

Table A.29 Double-differential inclusive cross-section $d^2\sigma/dp\,d\Omega$ [mb/(GeV/c sr)] of the production of π^+'s in p + Be $\to \pi^+ + X$ interactions with +15.0 GeV/c beam momentum; the first error is statistical, the second systematic; p_T in GeV/c, polar angle θ in degrees

p_T	$20 < \theta < 30$							$30 < \theta < 40$						
	$\langle p_T \rangle$	$\langle \theta \rangle$	$d^2\sigma/dp\,d\Omega$					$\langle p_T \rangle$	$\langle \theta \rangle$	$d^2\sigma/dp\,d\Omega$				
0.10–0.13	0.116	24.5	62.64	±	3.15	±	4.54	0.116	35.0	39.74	±	2.47	±	2.93
0.13–0.16	0.146	24.6	73.73	±	3.14	±	4.29	0.145	34.7	49.47	±	2.56	±	2.86
0.16–0.20	0.181	24.4	92.11	±	2.93	±	4.44	0.179	34.6	56.14	±	2.30	±	2.71
0.20–0.24	0.220	24.6	98.89	±	2.98	±	4.10	0.220	34.6	62.38	±	2.36	±	2.57
0.24–0.30	0.268	24.7	93.70	±	2.34	±	3.24	0.268	34.7	61.70	±	1.93	±	2.10
0.30–0.36	0.329	24.5	77.37	±	2.10	±	2.29	0.327	34.6	50.29	±	1.70	±	1.47
0.36–0.42	0.387	24.7	66.57	±	1.99	±	1.94	0.387	34.6	37.79	±	1.44	±	1.08
0.42–0.50	0.456	24.7	48.96	±	1.45	±	1.75	0.456	34.6	32.25	±	1.16	±	1.06
0.50–0.60	0.544	24.4	33.06	±	1.01	±	1.70	0.545	34.7	21.86	±	0.84	±	1.02
0.60–0.72	0.652	24.5	20.05	±	0.70	±	1.55	0.651	34.6	12.97	±	0.58	±	0.91
0.72–0.90								0.790	34.9	6.23	±	0.30	±	0.70
p_T	$40 < \theta < 50$							$50 < \theta < 60$						
	$\langle p_T \rangle$	$\langle \theta \rangle$	$d^2\sigma/dp\,d\Omega$					$\langle p_T \rangle$	$\langle \theta \rangle$	$d^2\sigma/dp\,d\Omega$				
0.10–0.13	0.117	45.0	28.29	±	2.11	±	2.15							
0.13–0.16	0.146	44.9	37.70	±	2.25	±	2.23	0.146	54.9	28.62	±	1.83	±	1.77
0.16–0.20	0.180	44.6	45.28	±	2.08	±	2.22	0.179	54.7	32.54	±	1.70	±	1.60
0.20–0.24	0.220	44.9	38.78	±	1.80	±	1.66	0.220	54.6	34.14	±	1.78	±	1.41
0.24–0.30	0.270	44.8	38.39	±	1.49	±	1.32	0.270	54.7	29.37	±	1.31	±	0.99
0.30–0.36	0.328	44.8	35.72	±	1.43	±	1.06	0.329	54.6	24.12	±	1.18	±	0.72
0.36–0.42	0.389	44.7	28.77	±	1.27	±	0.85	0.389	54.9	18.85	±	1.03	±	0.59
0.42–0.50	0.458	44.8	20.46	±	0.93	±	0.70	0.460	54.6	13.10	±	0.73	±	0.50
0.50–0.60	0.548	44.2	13.22	±	0.65	±	0.61	0.544	54.5	8.56	±	0.52	±	0.43
0.60–0.72	0.651	44.5	8.38	±	0.46	±	0.55	0.652	54.8	5.37	±	0.39	±	0.39
0.72–0.90	0.799	44.6	3.70	±	0.24	±	0.38	0.791	54.6	2.28	±	0.18	±	0.24
0.90–1.25								1.031	54.2	0.46	±	0.05	±	0.08
p_T	$60 < \theta < 75$							$75 < \theta < 90$						
	$\langle p_T \rangle$	$\langle \theta \rangle$	$d^2\sigma/dp\,d\Omega$					$\langle p_T \rangle$	$\langle \theta \rangle$	$d^2\sigma/dp\,d\Omega$				
0.13–0.16	0.145	67.4	19.67	±	1.23	±	1.28	0.147	82.2	17.61	±	1.17	±	1.23
0.16–0.20	0.181	67.4	22.41	±	1.15	±	1.12	0.179	82.1	17.64	±	0.98	±	0.92
0.20–0.24	0.220	67.2	25.84	±	1.21	±	1.04	0.221	82.2	15.72	±	0.92	±	0.61
0.24–0.30	0.269	66.8	18.14	±	0.83	±	0.59	0.266	82.4	12.29	±	0.69	±	0.39
0.30–0.36	0.329	66.8	13.63	±	0.70	±	0.41	0.327	82.3	9.85	±	0.63	±	0.34
0.36–0.42	0.389	67.1	11.48	±	0.65	±	0.45	0.389	82.1	5.41	±	0.44	±	0.24
0.42–0.50	0.456	66.9	7.64	±	0.44	±	0.34	0.460	82.0	3.58	±	0.30	±	0.22
0.50–0.60	0.544	66.4	6.23	±	0.38	±	0.38	0.548	81.5	2.26	±	0.21	±	0.18
0.60–0.72	0.654	66.4	2.57	±	0.20	±	0.22	0.657	81.3	1.06	±	0.13	±	0.11
0.72–0.90	0.789	66.8	1.05	±	0.11	±	0.14	0.787	81.0	0.32	±	0.06	±	0.05
0.90–1.25	1.008	64.8	0.16	±	0.02	±	0.03	1.052	78.8	0.05	±	0.02	±	0.02

Table A.29 (*Continued*)

p_T	$90 < \theta < 105$							$105 < \theta < 125$						
	$\langle p_T \rangle$	$\langle \theta \rangle$	$d^2\sigma/dp\,d\Omega$					$\langle p_T \rangle$	$\langle \theta \rangle$	$d^2\sigma/dp\,d\Omega$				
0.13–0.16	0.146	96.9	14.04	±	0.99	±	0.96	0.144	114.7	12.91	±	0.87	±	0.85
0.16–0.20	0.179	97.0	15.15	±	0.88	±	0.80	0.180	113.8	10.22	±	0.62	±	0.56
0.20–0.24	0.219	97.2	10.26	±	0.69	±	0.41	0.221	112.7	7.81	±	0.58	±	0.36
0.24–0.30	0.269	96.7	8.02	±	0.55	±	0.28	0.270	113.8	5.14	±	0.38	±	0.25
0.30–0.36	0.327	97.4	4.92	±	0.39	±	0.24	0.329	113.7	2.55	±	0.26	±	0.17
0.36–0.42	0.387	96.8	3.39	±	0.34	±	0.22	0.385	111.7	1.55	±	0.20	±	0.15
0.42–0.50	0.458	96.4	2.08	±	0.24	±	0.18	0.455	113.3	0.72	±	0.11	±	0.08
0.50–0.60	0.545	97.4	1.09	±	0.15	±	0.13	0.539	111.1	0.26	±	0.06	±	0.04
0.60–0.72	0.646	96.2	0.25	±	0.06	±	0.04	0.657	111.5	0.08	±	0.03	±	0.02
0.72–0.90	0.808	94.3	0.10	±	0.03	±	0.02							

Table A.30 Double-differential inclusive cross-section $d^2\sigma/dp\,d\Omega$ [mb/(GeV/c sr)] of the production of π^-'s in p + Be $\rightarrow \pi^-$ + X interactions with +15.0 GeV/c beam momentum; the first error is statistical, the second systematic; p_T in GeV/c, polar angle θ in degrees

p_T	$20 < \theta < 30$							$30 < \theta < 40$						
	$\langle p_T \rangle$	$\langle \theta \rangle$	$d^2\sigma/dp\,d\Omega$					$\langle p_T \rangle$	$\langle \theta \rangle$	$d^2\sigma/dp\,d\Omega$				
0.10–0.13	0.116	24.7	58.26	±	3.00	±	4.14	0.116	34.8	41.24	±	2.36	±	3.18
0.13–0.16	0.146	24.6	73.61	±	3.09	±	4.36	0.146	34.8	48.14	±	2.37	±	2.87
0.16–0.20	0.180	24.8	84.86	±	2.76	±	4.12	0.181	34.7	58.68	±	2.32	±	2.89
0.20–0.24	0.221	24.8	81.72	±	2.66	±	3.33	0.220	34.8	59.64	±	2.32	±	2.46
0.24–0.30	0.270	24.8	80.92	±	2.18	±	2.65	0.270	34.8	54.98	±	1.79	±	1.83
0.30–0.36	0.330	24.7	72.41	±	2.10	±	2.01	0.330	34.8	46.11	±	1.61	±	1.30
0.36–0.42	0.389	24.7	53.33	±	1.74	±	1.52	0.391	34.9	39.69	±	1.56	±	1.14
0.42–0.50	0.458	24.6	38.90	±	1.28	±	1.39	0.460	34.8	25.49	±	1.00	±	0.90
0.50–0.60	0.550	24.6	27.89	±	1.00	±	1.41	0.550	34.7	17.13	±	0.75	±	0.84
0.60–0.72	0.656	24.7	14.96	±	0.64	±	1.07	0.661	34.6	9.58	±	0.50	±	0.66
0.72–0.90								0.808	35.1	4.44	±	0.28	±	0.44
p_T	$40 < \theta < 50$							$50 < \theta < 60$						
	$\langle p_T \rangle$	$\langle \theta \rangle$	$d^2\sigma/dp\,d\Omega$					$\langle p_T \rangle$	$\langle \theta \rangle$	$d^2\sigma/dp\,d\Omega$				
0.10–0.13	0.117	44.8	29.37	±	2.10	±	2.53							
0.13–0.16	0.145	44.9	34.86	±	2.07	±	2.21	0.146	54.8	27.80	±	1.76	±	1.97
0.16–0.20	0.180	44.8	38.95	±	1.87	±	1.95	0.181	54.6	29.48	±	1.56	±	1.54
0.20–0.24	0.220	44.7	38.21	±	1.77	±	1.61	0.221	54.7	31.13	±	1.65	±	1.30
0.24–0.30	0.270	44.6	35.67	±	1.42	±	1.20	0.269	54.7	28.04	±	1.30	±	0.93
0.30–0.36	0.329	44.6	29.03	±	1.26	±	0.84	0.330	54.5	22.78	±	1.09	±	0.73
0.36–0.42	0.389	44.8	24.70	±	1.19	±	0.77	0.388	54.9	17.83	±	0.93	±	0.60
0.42–0.50	0.458	44.8	18.20	±	0.85	±	0.69	0.459	54.8	10.94	±	0.64	±	0.44
0.50–0.60	0.547	44.6	12.03	±	0.61	±	0.64	0.544	54.8	8.73	±	0.54	±	0.52
0.60–0.72	0.655	44.7	6.42	±	0.39	±	0.48	0.652	54.6	4.39	±	0.35	±	0.35
0.72–0.90	0.791	44.6	3.22	±	0.26	±	0.34	0.791	54.7	1.51	±	0.14	±	0.17
0.90–1.25								1.028	54.9	0.44	±	0.06	±	0.08

Table A.30 (*Continued*)

p_T	$60 < \theta < 75$							$75 < \theta < 90$						
	$\langle p_T \rangle$	$\langle \theta \rangle$	$d^2\sigma/dp\,d\Omega$					$\langle p_T \rangle$	$\langle \theta \rangle$	$d^2\sigma/dp\,d\Omega$				
0.13–0.16	0.145	67.2	22.57	±	1.34	±	1.67	0.146	81.7	16.54	±	1.11	±	1.23
0.16–0.20	0.180	67.0	21.41	±	1.03	±	1.11	0.180	82.5	16.80	±	0.89	±	0.95
0.20–0.24	0.220	67.3	21.47	±	1.05	±	0.83	0.220	82.0	17.27	±	0.98	±	0.80
0.24–0.30	0.269	66.9	19.54	±	0.87	±	0.61	0.268	82.1	12.08	±	0.65	±	0.38
0.30–0.36	0.329	66.9	12.82	±	0.66	±	0.39	0.329	82.0	7.94	±	0.50	±	0.29
0.36–0.42	0.387	66.9	10.25	±	0.56	±	0.39	0.389	81.6	6.04	±	0.46	±	0.30
0.42–0.50	0.457	66.9	7.75	±	0.45	±	0.39	0.457	81.6	4.24	±	0.34	±	0.29
0.50–0.60	0.546	66.8	5.93	±	0.37	±	0.39	0.543	82.0	2.64	±	0.23	±	0.22
0.60–0.72	0.651	67.0	2.23	±	0.17	±	0.20	0.651	82.8	0.76	±	0.11	±	0.09
0.72–0.90	0.798	66.6	0.84	±	0.09	±	0.11	0.788	82.4	0.32	±	0.06	±	0.05
0.90–1.25	1.025	66.3	0.18	±	0.03	±	0.04	1.018	80.3	0.05	±	0.02	±	0.02
p_T	$90 < \theta < 105$							$105 < \theta < 125$						
	$\langle p_T \rangle$	$\langle \theta \rangle$	$d^2\sigma/dp\,d\Omega$					$\langle p_T \rangle$	$\langle \theta \rangle$	$d^2\sigma/dp\,d\Omega$				
0.13–0.16	0.146	97.6	12.82	±	0.90	±	1.01	0.146	114.7	11.03	±	0.68	±	0.85
0.16–0.20	0.180	96.8	13.07	±	0.75	±	0.78	0.180	114.2	8.30	±	0.49	±	0.46
0.20–0.24	0.219	97.1	11.84	±	0.76	±	0.52	0.219	113.7	6.30	±	0.45	±	0.34
0.24–0.30	0.268	97.0	6.88	±	0.45	±	0.31	0.267	113.6	4.91	±	0.36	±	0.28
0.30–0.36	0.330	97.1	4.71	±	0.40	±	0.23	0.327	113.8	2.65	±	0.24	±	0.20
0.36–0.42	0.386	96.6	3.28	±	0.33	±	0.23	0.391	112.7	1.72	±	0.22	±	0.17
0.42–0.50	0.457	96.9	2.06	±	0.22	±	0.19	0.452	113.2	0.95	±	0.15	±	0.12
0.50–0.60	0.548	96.3	0.96	±	0.14	±	0.12	0.537	113.0	0.19	±	0.05	±	0.03
0.60–0.72	0.645	96.4	0.26	±	0.06	±	0.04	0.629	114.1	0.08	±	0.04	±	0.02
0.72–0.90	0.786	96.0	0.11	±	0.03	±	0.02							

Table A.31 Double-differential inclusive cross-section $d^2\sigma/dp\,d\Omega$ [mb/(GeV/c sr)] of the production of protons in $\pi^+ + \mathrm{Be} \to \mathrm{p} + \mathrm{X}$ interactions with +15.0 GeV/c beam momentum; the first error is statistical, the second systematic; p_T in GeV/c, polar angle θ in degrees

p_T	$20 < \theta < 30$							$30 < \theta < 40$						
	$\langle p_\mathrm{T}\rangle$	$\langle\theta\rangle$	$d^2\sigma/dp\,d\Omega$					$\langle p_\mathrm{T}\rangle$	$\langle\theta\rangle$	$d^2\sigma/dp\,d\Omega$				
0.20–0.24	0.218	24.2	16.22	±	9.16	±	1.13							
0.24–0.30	0.273	25.0	49.57	±	14.27	±	3.06	0.262	36.1	25.30	±	10.35	±	1.53
0.30–0.36	0.336	26.1	20.22	±	9.42	±	1.16	0.323	35.2	44.39	±	13.63	±	2.44
0.36–0.42	0.379	24.9	13.87	±	7.05	±	0.77	0.380	32.5	18.20	±	8.55	±	0.95
0.42–0.50	0.461	22.3	13.35	±	5.87	±	0.66	0.457	35.4	39.84	±	11.22	±	1.99
0.50–0.60	0.539	25.8	11.22	±	5.00	±	0.55	0.548	34.8	18.04	±	6.65	±	0.87
0.60–0.72	0.648	24.9	19.92	±	5.83	±	1.08	0.650	35.1	7.76	±	4.10	±	0.42
0.72–0.90								0.799	35.4	11.65	±	4.10	±	0.81
p_T	$40 < \theta < 50$							$50 < \theta < 60$						
	$\langle p_\mathrm{T}\rangle$	$\langle\theta\rangle$	$d^2\sigma/dp\,d\Omega$					$\langle p_\mathrm{T}\rangle$	$\langle\theta\rangle$	$d^2\sigma/dp\,d\Omega$				
0.30–0.36	0.335	43.6	22.96	±	9.40	±	1.24							
0.36–0.42	0.385	44.4	31.96	±	11.47	±	1.60	0.397	54.1	38.67	±	12.25	±	2.02
0.42–0.50	0.452	45.4	19.59	±	7.77	±	1.01	0.452	53.4	8.63	±	5.11	±	0.43
0.50–0.60	0.554	44.5	17.12	±	6.80	±	0.85	0.545	56.4	18.53	±	7.05	±	0.99
0.60–0.72	0.634	42.2	8.95	±	4.29	±	0.52	0.657	57.0	9.87	±	4.78	±	0.61
0.72–0.90	0.825	42.8	7.54	±	3.24	±	0.53	0.813	58.2	3.96	±	2.52	±	0.31
0.90–1.25	1.063	44.2	2.79	±	1.41	±	0.29	1.029	54.2	1.76	±	1.21	±	0.20
p_T	$60 < \theta < 75$							$75 < \theta < 90$						
	$\langle p_\mathrm{T}\rangle$	$\langle\theta\rangle$	$d^2\sigma/dp\,d\Omega$					$\langle p_\mathrm{T}\rangle$	$\langle\theta\rangle$	$d^2\sigma/dp\,d\Omega$				
0.36–0.42	0.396	70.2	21.16	±	7.49	±	1.08							
0.42–0.50	0.456	65.3	15.77	±	5.34	±	0.84	0.466	81.5	9.58	±	4.29	±	0.55
0.50–0.60	0.540	66.1	15.79	±	5.21	±	0.85	0.536	82.8	6.25	±	3.25	±	0.41
0.60–0.72	0.659	70.0	9.15	±	3.68	±	0.63	0.653	82.2	7.67	±	3.50	±	0.66
0.72–0.90	0.798	69.4	4.09	±	2.09	±	0.39	0.745	78.3	1.49	±	1.22	±	0.17
0.90–1.25	1.076	65.8	1.63	±	1.00	±	0.24							
p_T	$90 < \theta < 105$							$105 < \theta < 125$						
	$\langle p_\mathrm{T}\rangle$	$\langle\theta\rangle$	$d^2\sigma/dp\,d\Omega$					$\langle p_\mathrm{T}\rangle$	$\langle\theta\rangle$	$d^2\sigma/dp\,d\Omega$				
0.36–0.42								0.388	114.7	5.72	±	3.31	±	0.34
0.42–0.50	0.458	100.2	8.10	±	4.07	±	0.57	0.445	109.9	7.82	±	3.55	±	0.54
0.50–0.60	0.518	98.8	8.15	±	3.74	±	0.67							
0.60–0.72	0.649	99.3	2.61	±	2.07	±	0.27							

Table A.32 Double-differential inclusive cross-section $d^2\sigma/dp\,d\Omega$ [mb/(GeV/c sr)] of the production of π^+'s in $\pi^+ + \mathrm{Be} \to \pi^+ + \mathrm{X}$ interactions with +15.0 GeV/c beam momentum; the first error is statistical, the second systematic; p_T in GeV/c, polar angle θ in degrees

p_T	$20 < \theta < 30$							$30 < \theta < 40$						
	$\langle p_\mathrm{T}\rangle$	$\langle\theta\rangle$	$d^2\sigma/dp\,d\Omega$					$\langle p_\mathrm{T}\rangle$	$\langle\theta\rangle$	$d^2\sigma/dp\,d\Omega$				
0.13–0.16								0.141	33.9	42.30	±	19.30	±	3.17
0.16–0.20								0.180	35.1	33.27	±	15.08	±	2.11
0.24–0.30	0.264	24.6	44.67	±	13.69	±	2.14	0.267	33.6	40.55	±	13.55	±	2.02
0.30–0.36								0.330	35.2	49.89	±	15.04	±	2.37
0.36–0.42	0.378	24.5	69.69	±	17.99	±	3.31	0.391	35.8	21.90	±	9.77	±	1.07
0.42–0.50	0.461	24.6	48.52	±	12.79	±	2.45	0.456	34.0	29.16	±	9.56	±	1.50
0.50–0.60	0.555	23.4	33.71	±	8.82	±	2.12	0.527	35.4	9.19	±	4.60	±	0.57
0.60–0.72	0.656	25.5	24.11	±	6.89	±	2.08	0.641	36.8	5.15	±	3.38	±	0.43
0.72–0.90								0.809	32.7	4.61	±	2.24	±	0.57
p_T	$40 < \theta < 50$							$50 < \theta < 60$						
	$\langle p_\mathrm{T}\rangle$	$\langle\theta\rangle$	$d^2\sigma/dp\,d\Omega$					$\langle p_\mathrm{T}\rangle$	$\langle\theta\rangle$	$d^2\sigma/dp\,d\Omega$				
0.10–0.13	0.120	47.2	25.06	±	17.75	±	2.46							
0.13–0.16								0.150	54.4	24.24	±	14.06	±	2.18
0.16–0.20	0.185	44.4	26.34	±	13.40	±	1.79	0.174	55.7	13.90	±	9.85	±	0.99
0.20–0.24	0.223	45.8	38.82	±	15.92	±	2.42	0.221	53.4	26.72	±	13.47	±	1.80
0.24–0.30	0.275	44.3	36.38	±	12.86	±	1.95	0.262	56.3	18.39	±	8.71	±	1.04
0.30–0.36	0.332	45.0	37.02	±	12.44	±	1.93	0.319	55.4	13.61	±	7.84	±	0.75
0.36–0.42	0.397	45.5	21.52	±	9.61	±	1.17	0.387	54.7	26.06	±	10.64	±	1.60
0.42–0.50	0.458	43.4	15.84	±	7.07	±	0.91	0.457	56.4	9.77	±	5.64	±	0.65
0.50–0.60	0.545	43.7	7.56	±	4.36	±	0.50							
0.60–0.72	0.628	45.0	6.45	±	3.68	±	0.55							
0.72–0.90	0.777	43.9	6.20	±	2.86	±	0.73	0.744	55.6	2.54	±	1.79	±	0.34
p_T	$60 < \theta < 75$							$75 < \theta < 90$						
	$\langle p_\mathrm{T}\rangle$	$\langle\theta\rangle$	$d^2\sigma/dp\,d\Omega$					$\langle p_\mathrm{T}\rangle$	$\langle\theta\rangle$	$d^2\sigma/dp\,d\Omega$				
0.13–0.16	0.148	66.1	28.94	±	13.00	±	2.70	0.143	82.1	18.80	±	10.84	±	1.77
0.16–0.20	0.182	66.1	16.43	±	8.31	±	1.18	0.182	78.6	15.65	±	7.91	±	1.23
0.20–0.24	0.236	63.6	8.08	±	5.72	±	0.52	0.216	78.6	12.84	±	7.42	±	0.91
0.24–0.30	0.263	67.1	13.13	±	6.03	±	0.73	0.257	83.3	14.90	±	6.66	±	0.90
0.30–0.36	0.332	67.4	17.84	±	6.92	±	1.01	0.326	83.9	15.90	±	6.95	±	1.08
0.42–0.50	0.449	71.0	5.54	±	3.20	±	0.40	0.457	84.8	5.88	±	3.39	±	0.55
0.50–0.60								0.535	80.6	4.48	±	2.59	±	0.53
0.60–0.72	0.638	64.3	4.80	±	2.41	±	0.54							
0.72–0.90	0.807	63.9	0.15	±	0.11	±	0.02							
p_T	$90 < \theta < 105$							$105 < \theta < 125$						
	$\langle p_\mathrm{T}\rangle$	$\langle\theta\rangle$	$d^2\sigma/dp\,d\Omega$					$\langle p_\mathrm{T}\rangle$	$\langle\theta\rangle$	$d^2\sigma/dp\,d\Omega$				
0.13–0.16	0.141	98.0	28.25	±	12.65	±	3.10							
0.16–0.20								0.184	113.0	19.87	±	7.51	±	1.78
0.20–0.24	0.215	95.3	7.34	±	5.19	±	0.70	0.227	114.3	16.88	±	7.55	±	1.39
0.24–0.30	0.274	100.2	5.74	±	4.06	±	0.41	0.249	120.1	4.21	±	2.97	±	0.36
0.30–0.36	0.321	91.0	7.52	±	4.34	±	0.69							
0.36–0.42	0.405	94.9	5.56	±	3.93	±	0.57							
0.42–0.50	0.469	94.2	4.32	±	3.06	±	0.53							
0.50–0.60								0.539	112.7	2.46	±	1.74	±	0.52

Table A.33 Double-differential inclusive cross-section $d^2\sigma/dp\,d\Omega$ [mb/(GeV/c sr)] of the production of π^-'s in $\pi^+ + \mathrm{Be} \to \pi^- + \mathrm{X}$ interactions with +15.0 GeV/c beam momentum; the first error is statistical, the second systematic; p_T in GeV/c, polar angle θ in degrees

p_T	$20 < \theta < 30$							$30 < \theta < 40$						
	$\langle p_\mathrm{T}\rangle$	$\langle\theta\rangle$	$d^2\sigma/dp\,d\Omega$					$\langle p_\mathrm{T}\rangle$	$\langle\theta\rangle$	$d^2\sigma/dp\,d\Omega$				
0.10–0.13								0.122	31.7	16.01	±	11.79	±	1.53
0.13–0.16	0.156	24.6	21.23	±	14.83	±	1.52	0.146	32.6	25.48	±	14.08	±	2.05
0.16–0.20								0.184	33.9	42.39	±	17.35	±	2.84
0.20–0.24	0.221	24.2	43.46	±	16.56	±	2.41	0.217	35.7	13.82	±	9.80	±	0.84
0.24–0.30	0.270	24.9	62.09	±	16.68	±	3.00	0.263	35.9	27.09	±	11.10	±	1.40
0.30–0.36	0.329	23.9	58.34	±	16.19	±	2.72	0.335	33.4	24.25	±	9.91	±	1.22
0.36–0.42	0.388	23.3	32.11	±	11.40	±	1.55	0.391	33.3	39.28	±	13.14	±	2.15
0.42–0.50	0.463	24.5	28.44	±	9.49	±	1.52	0.457	34.6	23.96	±	8.47	±	1.45
0.50–0.60	0.533	24.9	13.74	±	6.15	±	0.90	0.542	35.4	25.50	±	8.07	±	1.84
0.60–0.72	0.673	23.9	6.00	±	3.47	±	0.52	0.656	33.4	5.93	±	3.43	±	0.55
p_T	$40 < \theta < 50$							$50 < \theta < 60$						
	$\langle p_\mathrm{T}\rangle$	$\langle\theta\rangle$	$d^2\sigma/dp\,d\Omega$					$\langle p_\mathrm{T}\rangle$	$\langle\theta\rangle$	$d^2\sigma/dp\,d\Omega$				
0.13–0.16								0.136	55.7	28.29	±	15.79	±	2.82
0.16–0.20	0.180	43.8	32.13	±	14.49	±	2.36	0.174	53.3	12.63	±	8.93	±	1.01
0.20–0.24	0.214	46.0	31.20	±	14.03	±	2.10	0.214	52.7	25.52	±	12.80	±	1.82
0.24–0.30	0.273	47.1	26.65	±	10.91	±	1.53	0.259	54.4	18.85	±	9.43	±	1.16
0.30–0.36	0.309	44.4	8.35	±	5.91	±	0.48	0.328	56.3	16.48	±	8.24	±	1.09
0.36–0.42	0.383	43.7	30.08	±	11.37	±	1.86							
0.42–0.50	0.460	44.1	27.12	±	9.04	±	1.84							
0.50–0.60	0.557	42.0	6.28	±	3.64	±	0.52	0.554	51.2	7.45	±	4.30	±	0.69
0.60–0.72								0.630	56.2	4.35	±	3.07	±	0.50
p_T	$60 < \theta < 75$							$75 < \theta < 90$						
	$\langle p_\mathrm{T}\rangle$	$\langle\theta\rangle$	$d^2\sigma/dp\,d\Omega$					$\langle p_\mathrm{T}\rangle$	$\langle\theta\rangle$	$d^2\sigma/dp\,d\Omega$				
0.13–0.16	0.146	65.7	23.65	±	11.86	±	2.22							
0.16–0.20	0.182	69.8	8.01	±	5.66	±	0.69	0.187	81.6	7.04	±	4.98	±	0.68
0.24–0.30								0.263	83.3	8.15	±	4.71	±	0.61
0.30–0.36	0.338	71.4	7.79	±	4.51	±	0.55							
0.36–0.42	0.389	69.7	16.51	±	6.25	±	1.42							
0.42–0.50								0.456	82.2	10.25	±	4.59	±	1.11
0.50–0.60	0.558	68.8	5.30	±	3.06	±	0.54							
p_T	$90 < \theta < 105$							$105 < \theta < 125$						
	$\langle p_\mathrm{T}\rangle$	$\langle\theta\rangle$	$d^2\sigma/dp\,d\Omega$					$\langle p_\mathrm{T}\rangle$	$\langle\theta\rangle$	$d^2\sigma/dp\,d\Omega$				
0.13–0.16								0.142	116.1	6.55	±	4.64	±	0.86
0.20–0.24	0.227	97.1	12.49	±	6.70	±	1.23							
0.24–0.30	0.256	97.2	6.67	±	3.86	±	0.70							

Table A.34 Double-differential inclusive cross-section $d^2\sigma/dp\,d\Omega$ [mb/(GeV/c sr)] of the production of protons in $\pi^- + \mathrm{Be} \to \mathrm{p} + \mathrm{X}$ interactions with -15.0 GeV/c beam momentum; the first error is statistical, the second systematic; p_T in GeV/c, polar angle θ in degrees

p_T	$20 < \theta < 30$							$30 < \theta < 40$						
	$\langle p_\mathrm{T}\rangle$	$\langle\theta\rangle$	$d^2\sigma/dp\,d\Omega$					$\langle p_\mathrm{T}\rangle$	$\langle\theta\rangle$	$d^2\sigma/dp\,d\Omega$				
0.20–0.24	0.219	24.9	25.27	±	1.11	±	1.86							
0.24–0.30	0.268	24.7	27.07	±	0.93	±	1.66	0.267	34.8	24.14	±	0.87	±	1.47
0.30–0.36	0.327	24.8	25.87	±	0.90	±	1.51	0.326	35.0	22.96	±	0.84	±	1.41
0.36–0.42	0.385	25.0	23.79	±	0.85	±	1.25	0.385	34.9	21.30	±	0.83	±	1.12
0.42–0.50	0.451	24.7	21.24	±	0.69	±	1.03	0.452	35.0	18.90	±	0.67	±	0.94
0.50–0.60	0.538	25.0	17.99	±	0.56	±	0.86	0.538	34.9	15.67	±	0.55	±	0.76
0.60–0.72	0.642	24.9	12.92	±	0.43	±	0.70	0.642	34.8	11.46	±	0.43	±	0.63
0.72–0.90								0.778	35.0	6.81	±	0.26	±	0.47
p_T	$40 < \theta < 50$							$50 < \theta < 60$						
	$\langle p_\mathrm{T}\rangle$	$\langle\theta\rangle$	$d^2\sigma/dp\,d\Omega$					$\langle p_\mathrm{T}\rangle$	$\langle\theta\rangle$	$d^2\sigma/dp\,d\Omega$				
0.30–0.36	0.331	45.1	23.42	±	0.85	±	1.19							
0.36–0.42	0.389	45.0	20.03	±	0.79	±	1.06	0.389	54.9	19.23	±	0.76	±	1.04
0.42–0.50	0.458	44.9	17.40	±	0.64	±	0.85	0.458	54.9	15.32	±	0.59	±	0.81
0.50–0.60	0.545	44.9	11.91	±	0.49	±	0.60	0.548	54.9	12.11	±	0.49	±	0.65
0.60–0.72	0.653	44.8	9.01	±	0.38	±	0.52	0.654	55.0	7.68	±	0.37	±	0.48
0.72–0.90	0.799	45.0	5.25	±	0.25	±	0.37	0.797	55.0	4.33	±	0.23	±	0.34
0.90–1.25	1.029	45.3	1.61	±	0.10	±	0.17	1.029	54.8	1.17	±	0.08	±	0.14
p_T	$60 < \theta < 75$							$75 < \theta < 90$						
	$\langle p_\mathrm{T}\rangle$	$\langle\theta\rangle$	$d^2\sigma/dp\,d\Omega$					$\langle p_\mathrm{T}\rangle$	$\langle\theta\rangle$	$d^2\sigma/dp\,d\Omega$				
0.36–0.42	0.389	67.3	17.30	±	0.57	±	0.88							
0.42–0.50	0.459	67.2	14.62	±	0.47	±	0.74	0.458	81.9	11.01	±	0.41	±	0.62
0.50–0.60	0.546	67.3	10.63	±	0.37	±	0.58	0.547	81.7	6.96	±	0.30	±	0.47
0.60–0.72	0.652	66.9	6.64	±	0.28	±	0.46	0.652	82.1	3.63	±	0.21	±	0.32
0.72–0.90	0.797	67.0	2.96	±	0.15	±	0.29	0.790	81.9	1.48	±	0.11	±	0.18
0.90–1.25	1.029	66.6	0.86	±	0.06	±	0.13	1.029	81.0	0.38	±	0.04	±	0.07
p_T	$90 < \theta < 105$							$105 < \theta < 125$						
	$\langle p_\mathrm{T}\rangle$	$\langle\theta\rangle$	$d^2\sigma/dp\,d\Omega$					$\langle p_\mathrm{T}\rangle$	$\langle\theta\rangle$	$d^2\sigma/dp\,d\Omega$				
0.36–0.42								0.387	113.5	5.43	±	0.28	±	0.35
0.42–0.50	0.459	97.0	6.51	±	0.32	±	0.49	0.456	113.8	3.08	±	0.19	±	0.23
0.50–0.60	0.545	96.4	3.49	±	0.21	±	0.31	0.540	112.8	1.38	±	0.12	±	0.16
0.60–0.72	0.650	96.4	1.56	±	0.14	±	0.18	0.653	112.6	0.52	±	0.07	±	0.09
0.72–0.90	0.794	95.0	0.59	±	0.07	±	0.09	0.789	112.6	0.12	±	0.03	±	0.03
0.90–1.25	1.020	95.4	0.16	±	0.03	±	0.04							

Table A.35 Double-differential inclusive cross-section $d^2\sigma/dp\,d\Omega$ [mb/(GeV/c sr)] of the production of π^+'s in $\pi^- + \mathrm{Be} \to \pi^+ + \mathrm{X}$ interactions with -15.0 GeV/c beam momentum; the first error is statistical, the second systematic; p_T in GeV/c, polar angle θ in degrees

p_T	$20 < \theta < 30$							$30 < \theta < 40$						
	$\langle p_\mathrm{T}\rangle$	$\langle\theta\rangle$	$d^2\sigma/dp\,d\Omega$					$\langle p_\mathrm{T}\rangle$	$\langle\theta\rangle$	$d^2\sigma/dp\,d\Omega$				
0.10–0.13	0.115	24.6	45.98	±	2.08	±	3.81	0.115	35.0	30.15	±	1.63	±	2.64
0.13–0.16	0.145	24.7	55.61	±	2.07	±	3.90	0.145	35.0	39.64	±	1.77	±	2.80
0.16–0.20	0.180	24.7	63.93	±	1.87	±	3.75	0.179	34.8	42.87	±	1.54	±	2.59
0.20–0.24	0.219	24.6	75.96	±	2.01	±	4.00	0.219	34.6	43.58	±	1.50	±	2.36
0.24–0.30	0.268	24.5	64.35	±	1.48	±	3.00	0.266	34.5	42.01	±	1.19	±	2.00
0.30–0.36	0.326	24.6	56.74	±	1.38	±	2.47	0.325	34.7	36.88	±	1.13	±	1.64
0.36–0.42	0.384	24.6	46.39	±	1.24	±	2.01	0.385	34.4	27.42	±	0.94	±	1.23
0.42–0.50	0.451	24.6	34.24	±	0.91	±	1.67	0.452	34.7	20.07	±	0.69	±	0.97
0.50–0.60	0.539	24.6	24.03	±	0.66	±	1.47	0.538	34.7	15.30	±	0.54	±	0.91
0.60–0.72	0.643	24.5	12.77	±	0.42	±	1.09	0.642	34.5	7.79	±	0.32	±	0.64
0.72–0.90								0.781	34.6	3.80	±	0.17	±	0.45
p_T	$40 < \theta < 50$							$50 < \theta < 60$						
	$\langle p_\mathrm{T}\rangle$	$\langle\theta\rangle$	$d^2\sigma/dp\,d\Omega$					$\langle p_\mathrm{T}\rangle$	$\langle\theta\rangle$	$d^2\sigma/dp\,d\Omega$				
0.10–0.13	0.116	44.7	21.46	±	1.42	±	2.01							
0.13–0.16	0.146	44.8	27.03	±	1.44	±	2.01	0.145	55.1	18.40	±	1.14	±	1.59
0.16–0.20	0.181	45.0	26.95	±	1.21	±	1.69	0.179	54.8	21.02	±	1.04	±	1.36
0.20–0.24	0.219	44.6	28.62	±	1.23	±	1.61	0.220	54.9	19.66	±	0.99	±	1.17
0.24–0.30	0.269	44.7	26.03	±	0.93	±	1.30	0.271	54.6	18.09	±	0.78	±	0.93
0.30–0.36	0.330	44.8	22.51	±	0.87	±	1.05	0.328	54.6	15.71	±	0.71	±	0.77
0.36–0.42	0.389	44.7	18.31	±	0.77	±	0.88	0.390	54.6	12.43	±	0.63	±	0.68
0.42–0.50	0.459	44.7	14.34	±	0.59	±	0.73	0.457	54.8	8.54	±	0.44	±	0.52
0.50–0.60	0.547	44.7	8.60	±	0.39	±	0.55	0.546	54.5	5.77	±	0.32	±	0.43
0.60–0.72	0.654	44.7	5.52	±	0.29	±	0.44	0.654	54.4	3.37	±	0.22	±	0.30
0.72–0.90	0.792	44.6	2.17	±	0.14	±	0.25	0.797	54.7	1.37	±	0.11	±	0.17
0.90–1.25								1.020	55.0	0.24	±	0.03	±	0.05
p_T	$60 < \theta < 75$							$75 < \theta < 90$						
	$\langle p_\mathrm{T}\rangle$	$\langle\theta\rangle$	$d^2\sigma/dp\,d\Omega$					$\langle p_\mathrm{T}\rangle$	$\langle\theta\rangle$	$d^2\sigma/dp\,d\Omega$				
0.13–0.16	0.146	67.0	13.85	±	0.81	±	1.11	0.146	82.4	10.71	±	0.70	±	0.95
0.16–0.20	0.180	67.1	14.41	±	0.67	±	0.98	0.180	82.3	11.12	±	0.59	±	0.88
0.20–0.24	0.220	67.2	15.85	±	0.73	±	0.90	0.219	82.1	11.09	±	0.60	±	0.67
0.24–0.30	0.268	67.0	12.71	±	0.53	±	0.63	0.268	82.2	7.35	±	0.39	±	0.42
0.30–0.36	0.328	66.9	9.96	±	0.46	±	0.51	0.330	81.4	5.88	±	0.34	±	0.39
0.36–0.42	0.389	67.0	7.93	±	0.41	±	0.45	0.389	82.0	3.82	±	0.27	±	0.30
0.42–0.50	0.460	67.2	5.04	±	0.28	±	0.36	0.457	82.0	2.84	±	0.20	±	0.29
0.50–0.60	0.544	66.3	3.80	±	0.22	±	0.31	0.546	81.6	1.67	±	0.14	±	0.17
0.60–0.72	0.654	66.4	1.72	±	0.12	±	0.21	0.652	81.9	0.81	±	0.08	±	0.12
0.72–0.90	0.791	65.9	0.66	±	0.06	±	0.10	0.813	81.1	0.17	±	0.03	±	0.04
0.90–1.25	1.030	67.1	0.11	±	0.02	±	0.03	1.016	81.0	0.04	±	0.01	±	0.02

Table A.35 (*Continued*)

p_T	$90 < \theta < 105$							$105 < \theta < 125$						
	$\langle p_T \rangle$	$\langle \theta \rangle$	$d^2\sigma/dp\,d\Omega$					$\langle p_T \rangle$	$\langle \theta \rangle$	$d^2\sigma/dp\,d\Omega$				
0.13–0.16	0.145	97.7	7.88	±	0.59	±	0.79	0.145	114.0	7.20	±	0.46	±	0.75
0.16–0.20	0.181	96.9	8.14	±	0.49	±	0.61	0.179	114.3	6.60	±	0.36	±	0.58
0.20–0.24	0.219	97.3	7.33	±	0.46	±	0.57	0.217	114.6	3.84	±	0.29	±	0.33
0.24–0.30	0.268	97.4	5.37	±	0.33	±	0.33	0.268	113.2	3.15	±	0.22	±	0.25
0.30–0.36	0.328	97.2	3.68	±	0.28	±	0.26	0.327	112.5	1.85	±	0.16	±	0.19
0.36–0.42	0.387	96.5	2.27	±	0.20	±	0.24	0.386	111.8	1.03	±	0.12	±	0.14
0.42–0.50	0.458	95.7	1.66	±	0.16	±	0.19	0.460	112.3	0.46	±	0.07	±	0.09
0.50–0.60	0.549	95.4	0.61	±	0.08	±	0.10	0.545	113.3	0.21	±	0.04	±	0.05
0.60–0.72	0.647	96.9	0.26	±	0.05	±	0.05	0.646	110.9	0.07	±	0.02	±	0.02
0.72–0.90	0.763	95.3	0.08	±	0.02	±	0.04							

Table A.36 Double-differential inclusive cross-section $d^2\sigma/dp\,d\Omega$ [mb/(GeV/c sr)] of the production of π^-'s in $\pi^- + \mathrm{Be} \to \pi^- + \mathrm{X}$ interactions with -15.0 GeV/c beam momentum; the first error is statistical, the second systematic; p_T in GeV/c, polar angle θ in degrees

p_T	$20 < \theta < 30$							$30 < \theta < 40$						
	$\langle p_T \rangle$	$\langle \theta \rangle$	$d^2\sigma/dp\,d\Omega$					$\langle p_T \rangle$	$\langle \theta \rangle$	$d^2\sigma/dp\,d\Omega$				
0.10–0.13	0.115	24.6	57.96	±	2.29	±	4.67	0.116	34.8	36.13	±	1.78	±	3.15
0.13–0.16	0.146	24.7	74.78	±	2.42	±	5.04	0.146	34.6	44.08	±	1.83	±	3.12
0.16–0.20	0.182	24.5	83.43	±	2.14	±	4.84	0.181	34.6	49.76	±	1.63	±	2.99
0.20–0.24	0.221	24.6	90.28	±	2.19	±	4.63	0.222	34.7	55.36	±	1.69	±	2.95
0.24–0.30	0.272	24.5	84.12	±	1.71	±	3.75	0.271	34.6	52.07	±	1.34	±	2.40
0.30–0.36	0.332	24.6	74.96	±	1.62	±	3.10	0.333	34.7	42.92	±	1.21	±	1.85
0.36–0.42	0.394	24.6	62.60	±	1.48	±	2.64	0.394	34.6	37.25	±	1.13	±	1.63
0.42–0.50	0.464	24.6	46.78	±	1.10	±	2.21	0.464	34.6	28.82	±	0.86	±	1.39
0.50–0.60	0.555	24.6	30.44	±	0.80	±	1.80	0.555	34.8	21.50	±	0.67	±	1.30
0.60–0.72	0.667	24.6	19.92	±	0.59	±	1.62	0.667	34.6	11.61	±	0.44	±	0.92
0.72–0.90								0.815	34.7	5.84	±	0.26	±	0.62
p_T	$40 < \theta < 50$							$50 < \theta < 60$						
	$\langle p_T \rangle$	$\langle \theta \rangle$	$d^2\sigma/dp\,d\Omega$					$\langle p_T \rangle$	$\langle \theta \rangle$	$d^2\sigma/dp\,d\Omega$				
0.10–0.13	0.116	44.8	28.52	±	1.55	±	2.71							
0.13–0.16	0.146	44.8	31.34	±	1.50	±	2.34	0.145	54.8	24.85	±	1.34	±	1.93
0.16–0.20	0.179	44.7	35.76	±	1.39	±	2.21	0.181	54.8	27.65	±	1.19	±	1.77
0.20–0.24	0.220	44.8	39.50	±	1.44	±	2.20	0.220	54.7	29.04	±	1.23	±	1.63
0.24–0.30	0.270	44.7	32.91	±	1.04	±	1.57	0.271	54.7	22.29	±	0.86	±	1.14
0.30–0.36	0.328	44.6	30.34	±	1.02	±	1.36	0.330	54.8	20.09	±	0.82	±	0.95
0.36–0.42	0.388	44.8	22.96	±	0.87	±	1.07	0.389	54.6	15.70	±	0.71	±	0.78
0.42–0.50	0.460	44.5	17.64	±	0.66	±	0.99	0.458	54.6	13.51	±	0.58	±	0.75
0.50–0.60	0.546	44.7	13.49	±	0.53	±	0.88	0.544	54.7	8.32	±	0.41	±	0.57
0.60–0.72	0.654	44.5	7.21	±	0.35	±	0.60	0.649	54.6	4.74	±	0.28	±	0.42
0.72–0.90	0.795	44.7	3.79	±	0.21	±	0.43	0.789	54.7	1.90	±	0.14	±	0.23
0.90–1.25								1.015	54.3	0.39	±	0.04	±	0.08

Table A.36 (*Continued*)

p_T	$60 < \theta < 75$							$75 < \theta < 90$						
	$\langle p_T \rangle$	$\langle \theta \rangle$	$d^2\sigma/dp\,d\Omega$					$\langle p_T \rangle$	$\langle \theta \rangle$	$d^2\sigma/dp\,d\Omega$				
0.13–0.16	0.145	67.6	20.41	±	0.97	±	1.67	0.146	82.5	15.64	±	0.82	±	1.46
0.16–0.20	0.181	67.2	21.23	±	0.82	±	1.37	0.181	82.3	16.90	±	0.72	±	1.22
0.20–0.24	0.220	67.1	21.39	±	0.85	±	1.25	0.219	82.5	14.29	±	0.67	±	0.82
0.24–0.30	0.268	66.8	16.96	±	0.61	±	0.80	0.267	82.0	11.35	±	0.49	±	0.57
0.30–0.36	0.328	66.6	14.09	±	0.56	±	0.66	0.329	82.1	7.47	±	0.40	±	0.41
0.36–0.42	0.389	66.8	10.59	±	0.47	±	0.63	0.390	81.7	6.32	±	0.37	±	0.41
0.42–0.50	0.456	66.9	7.76	±	0.35	±	0.48	0.459	81.5	3.68	±	0.24	±	0.30
0.50–0.60	0.549	66.9	5.45	±	0.27	±	0.41	0.540	82.2	2.53	±	0.18	±	0.24
0.60–0.72	0.653	66.3	2.13	±	0.14	±	0.24	0.648	81.4	1.08	±	0.10	±	0.14
0.72–0.90	0.795	67.0	0.87	±	0.08	±	0.12	0.787	80.0	0.40	±	0.05	±	0.07
0.90–1.25	1.038	65.4	0.15	±	0.02	±	0.03	0.994	80.2	0.05	±	0.02	±	0.02
p_T	$90 < \theta < 105$							$105 < \theta < 125$						
	$\langle p_T \rangle$	$\langle \theta \rangle$	$d^2\sigma/dp\,d\Omega$					$\langle p_T \rangle$	$\langle \theta \rangle$	$d^2\sigma/dp\,d\Omega$				
0.13–0.16	0.146	97.0	13.15	±	0.74	±	1.20	0.144	114.4	10.34	±	0.55	±	0.95
0.16–0.20	0.179	97.3	14.11	±	0.63	±	1.19	0.179	114.5	9.61	±	0.45	±	0.70
0.20–0.24	0.219	96.5	10.65	±	0.58	±	0.70	0.217	113.6	7.21	±	0.40	±	0.52
0.24–0.30	0.268	97.2	8.52	±	0.43	±	0.47	0.269	113.8	4.65	±	0.27	±	0.34
0.30–0.36	0.330	96.4	5.10	±	0.33	±	0.34	0.329	113.6	2.88	±	0.21	±	0.25
0.36–0.42	0.389	97.0	3.90	±	0.28	±	0.36	0.390	114.2	1.58	±	0.15	±	0.20
0.42–0.50	0.460	96.5	2.41	±	0.19	±	0.28	0.454	112.7	1.00	±	0.10	±	0.15
0.50–0.60	0.547	96.7	0.95	±	0.11	±	0.15	0.542	112.1	0.42	±	0.06	±	0.08
0.60–0.72	0.657	96.8	0.46	±	0.07	±	0.09	0.631	115.2	0.15	±	0.04	±	0.04
0.72–0.90	0.796	95.1	0.14	±	0.03	±	0.04							

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